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The Canada Water Act Annual Report

1987-1988

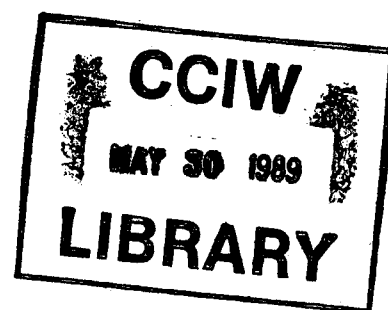
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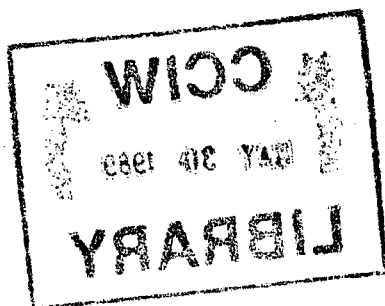
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The Canada Water Act Annual Report

1987-1988



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Minister of the Environment



Ministre de l'Environnement

Her Excellency
The Right Honourable Jeanne Sauvé, C.C., C.M.M., C.D.
Governor General of Canada
Rideau Hall
Ottawa, Canada
K1A 0A1

Her Excellency,

I respectfully submit to Your Excellency and to the
Parliament of Canada the annual report on operations under
the Canada Water Act for the fiscal year 1987-88.

I have the honour to be, Madam, Your Excellency's obedient
servant,

A handwritten signature in black ink, appearing to read "Lucien Bouchard".

Lucien Bouchard



Deputy Minister
Environment Canada

Sous-ministre
Environnement Canada

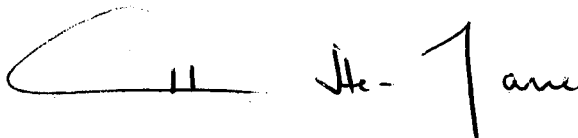
Ottawa, Canada
K1A 0H3

The Honorable Lucien Bouchard, P.C., M.P.,
Minister of the Environment,
Ottawa, Canada.
K1A 0A6

Dear Mr. Bouchard,

I have the honour to submit the Annual Report on
operations under the Canada Water Act for the fiscal
year 1987-88.

Sincerely,



G.A. Sainte-Marie

Canada

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Introduction

The Canada Water Act, proclaimed on September 30, 1970, provides the framework for joint federal-provincial management of Canada's water resources. Section 36 of the Act requires that a report on operations under the Act be laid before Parliament as soon as possible after the end of each fiscal year. This, the sixteenth annual report, covers operations to March 31, 1988.

On November 5, 1987, the Federal Water Policy was tabled in Parliament. The policy, the first of its kind in Canada, has been formulated after several years of intensive consultation both within and outside the government. More details are given on page 3.

Up to and including fiscal year 1975-76, the Canada Water Act funding for federal-provincial

projects was provided on the basis of individual projects. In fiscal year 1976-77, Treasury Board established a ceiling on expenditures cost-shared with the provinces (for river basin planning and implementation, and flood damage reduction) at about an \$18 million per year level. Subsequently, budget reductions and consequent adjustments to the program lowered the ceiling in 1984-85 to \$11 million per year. This total fell to \$9.2 million for 1985-86 and stayed near this level in fiscal years 1986-87 and 1987-88.

In addition to joint federal-provincial undertakings, this report describes other federal activities under the Act, including water research, data management, and public information programs.

Provisions of the Canada Water Act

Part I of the Act provides for the establishment of federal-provincial consultative arrangements for water resource matters (section 3) and for cooperative agreements with the provinces to develop and implement plans for the management of water resources (sections 4 to 7). This part also enables the Minister, directly, or in cooperation with any provincial government, institution, or person, to conduct research, collect data, and establish inventories associated with the water resources.

Part II envisages federal-provincial management where water quality has become a matter of urgent national concern. It permits the establishment of joint federal-provincial incorporated agencies (although existing federal and provincial corporations might alternatively be used) to plan and implement approved water quality management programs.

Part III of the Canada Water Act provides for regulations banning the manufacture or import for use or sale in Canada of any cleaning agent or water conditioner that contains a nutrient in a greater concentration than that prescribed by regulations. This is one of the principal means of reducing the rate of eutrophication of water bodies. At the time of writing, this part of the Canada Water Act had just been transferred to Bill C-74, soon to become the new Canadian Environmental Protection Act.

Part IV of the Canada Water Act contains provisions for its general administration. In addition, Part IV provides for inspection and enforcement, allows the Minister to establish Advisory Committees and permits the Minister, either directly or in cooperation with any government, institution, or person, to undertake public information programs.

Activities under the Canada Water Act

Federal Water Policy Announced

The connectedness of nature is more pervasive and the context for water policy more expansive than has previously been believed.

- Canadian Meteorological and Oceanographic Society

So begins the Final Report of the Inquiry on Federal Water Policy, *Currents of Change*. The Pearce Inquiry findings underscore that "the problems in water management are no longer local ones of water supply and pollution; but rather regional and even global problems...." After months of careful deliberation (detailed in the Background below), the federal government has developed Canada's first comprehensive water policy. It addresses the management of our water resources holistically, balancing water uses with the requirements of the many interrelationships within our ecosystem.

The Federal Water Policy states the federal government's philosophy and goals for the nation's freshwater resources, and the ways it proposes to achieve them. The policy takes into full account the needs of all Canadians in its overall objective below:

- To encourage the use of freshwater in an efficient and equitable manner consistent with the social, economic and environmental needs of present and future generations.

At the same time, the policy stresses that government action is not enough. Canadians themselves must recognize the true value of water in their daily lives and use it wisely. Water can no longer be undervalued and therefore wasted. Canada has sufficient water resources, but most of it is not where it is needed, i.e., in the populated areas of the country. In those populated areas when it is plentiful, water is often polluted to the extent that some uses are constrained.

To manage Canada's water resources, the federal government has defined two main goals:

- To protect and enhance the quality of the water resource.

- To promote the wise and efficient management and use of water.

In achieving these goals, two important principles will be encouraged: (1) the "pollutor pays" principle, where economic penalties are imposed on polluters and the inevitable costs of pollution reduction are redirected to those responsible, and (2) the "beneficiary pays" principle, where the users pay for water and wastewater services by means of appropriate prices.

Water pricing is one of five broad strategies adopted by the federal government to deal with Canada's current and anticipated water issues. The other strategies concern federal leadership in water science; an integrated approach to water resource planning involving all sectors of society; a strengthening of water legislation; and a public awareness program on water issues.

Background

In all cases, the federal government will be guided by the report of the Federal Inquiry on Water Policy, which submitted its findings in September 1985. In January 1984, this three-member Advisory Committee known as the Pearce Inquiry was appointed by the Environment Canada Minister under section 26 of the Canada Water Act in response to a growing environmental consciousness and concern about the management of Canada's freshwater resources. The Pearce Inquiry held public hearings across Canada and reviewed several hundred written submissions from individuals and organizations. To ensure a broad range of facts, viewpoints and advice, the Inquiry consulted frequently with provincial and territorial officials and many federal agencies. *Currents of Change*, published in 1985, is the culmination of the Inquiry's efforts. Its thought-provoking findings and recommendations make up the cornerstone of the new Federal Water Policy.

Upon publication of *Currents of Change*, the Minister established an Interdepartmental Water Policy Task Force to advise on the Inquiry's

recommendations and to develop the framework for a federal water policy. Provincial ministers discussed the Inquiry's final report at meetings of the Canadian Council of Resource Ministers in 1985 and 1986. As well, the report was discussed at a meeting for non-government organizations in November 1985, held in conjunction with Environment Canada's annual public consultations.

Released in March 1987, the report of the Task Force responded to the Inquiry's recommendations and provided advice on the scope and nature of an appropriate federal water policy. By November 1987, the policy was finalized.

APPLYING THE POLICY

Each department and agency of the federal government is responsible for the implementation of the Federal Water Policy. In 1987, the federal government undertook the following initiatives:

- The Interdepartmental Committee on Water, reconstructed and provided with a broader mandate and revised terms of reference, was designated as the focal point for coordinating federal water programs to ensure compliance with the spirit and intent of the Federal Water Policy.
- Throughout 1987, the Minister of the Environment made a number of speeches related to the Policy. The key message has been that Canadians should recognize the value of their water resources. As long as Canadians undervalue their water they will continue to use it unwisely.
- In anticipation of the Federal Water Policy, a departmental steering committee on legislative review was established in August 1987 to assess the adequacy of existing legislation and to recommend any necessary changes in support of the policy.

At the federal-provincial level, the adoption and application of Federal Water Policy goals and strategies will be encouraged through existing and improved federal-provincial coordinating mechanisms and bilateral arrangements. For example, in the fall of 1987, the Water Advisory Committee of the

Canadian Council of Resource and Environment Ministers initiated a review of federal and provincial water policies, including water pricing, water legislation, and approaches to planning, to determine degrees of consistency and compatibility of approaches.

At the international level, the Federal Water Policy will guide Canadian officials over the next decade in bilateral and multilateral dealings with other national governments on water-related programs and activities.

SPECIFIC POLICY STATEMENTS

The federal government has drawn up 25 specific policy statements to be used in applying the five policy strategies. The range of concerns is not intended to be exhaustive, and the policies will evolve in response to changing conditions:

-
1. Management of Toxic Substances
 2. Water Quality Management
 3. Ground Water Contamination
 4. Fish Habitat Management
 5. Provision of Municipal Water and Sewer Infrastructure
 6. Safe Drinking Water
 7. Water Use Conflicts
 8. Interbasin Transfers
 9. Water Use in Irrigation
 10. Wetlands Preservation
 11. Hydroelectric Energy Development
 12. Navigation
 13. Heritage River Preservation
 14. Management of Northern Water Resources
 15. Native Water Rights
 16. Canada-U.S. Boundary and Transboundary Water Management
 17. Potential Interjurisdictional Water Conflicts within Canada
 18. International Water Relations
 19. Drought
 20. Flooding
 21. Shoreline Erosion
 22. Climate Change
 23. Water Data and Information Needs
 24. Research Leadership
 25. Technological Needs
-

GREAT LAKES WATER LEVEL COMMUNICATIONS CENTRE

Steady improvements in Great Lakes water levels toward the end of 1986 and in 1987 have diminished the threat of flood and erosion damage along Great Lakes shorelines. Widespread low precipitation over the lakes since late 1986 has reduced water supplies, causing levels to decrease. The risk of damage was high in 1985 and 1986 due to a prolonged period of above-average precipitation over the Great Lakes basin, creating very high water supplies to the lakes.

To meet the problem of the record high Great Lakes levels, in March of 1986 the Environment Minister established the Great Lakes Water Level Communications Centre, which is located at the Canada Centre for Inland Waters in Burlington, Ontario. In 1987-88, the Centre continued to coordinate federal activities related to fluctuating Great Lakes water levels. Centre personnel responded to

900 telephone enquiries from the general public and media. As well, they worked around the clock, or on extended hours, during approximately 30 high water level watches and warnings to provide the public with up-to-the-minute information. Centre staff developed and updated information material, responded to speaking invitations, and carried out a Community Information Session program in cooperation with the International Joint Commission and the Ontario Ministry of Natural Resources: 13 sessions were held with governments and residents of communities bordering on the Great Lakes. In all, Centre personnel gave 45 presentations to various groups throughout the year.

As well as disseminating information, the Centre gathers information for its database on flood and erosion damage. A survey of the flood damage potential for commercial and industrial properties along Lake Superior was completed, and a similar survey for residential properties is being drafted.

Part I: Comprehensive Water Resource Management

FEDERAL-PROVINCIAL COOPERATION

The Canada Water Act calls for joint consultation between the federal and provincial governments in matters related to water resources. Discussed briefly in the following are joint programs under the national Flood Damage Reduction Program as well as other projects involving the regulation, apportionment, monitoring or survey of water resources, and the preplanning, planning or implementation of water management programs.

Agreements for specific water programs provide for the participating governments to contribute funding, information, and expertise in agreed ratios. For ongoing activities such as the water quantity survey agreements with each province, cost-sharing is in accordance with each party's need for the data. For study and planning agreements, it is usual for the federal government to meet half the costs and the provincial government(s) the other half. The planning studies encompass interprovincial, international or other basins where federal interests are important. Implementation of planning recommendations occurs on a federal, provincial, and federal-provincial basis. Cost-sharing of the construction of works often includes a contribution from local governments.

INTERDEPARTMENTAL COMMITTEE ON WATER

The Interdepartmental Committee on Water (ICW) was established in 1968 to promote coordination and to advise on all federal water programs. Since then, ICW has actively pursued its mandate and, in June 1987, held the 58th and last meeting under its original mandate.

The committee has accepted the recommendations of its Mandate Review Task Force, and in line with the recommendations of the Pearce Inquiry on Federal Water Policy, a new ICW mandate in support of the recent Federal Water Policy was approved as part of the Federal Water Policy in November of 1987. The restructured and strengthened ICW will now be responsible for

advising on the development, coordination and implementation of federal water policy. Membership has been reduced to nine departments that have a significant interest in water: Environment Canada, Fisheries and Oceans; External Affairs, Agriculture Canada; Health and Welfare Canada; Indian and Northern Affairs; Regional Industrial Expansion; Energy, Mines and Resources; and Transport Canada. The Chair will reside with Environment Canada.

During 1987, five active subcommittees focussed on the following:

- Canada-U.S. and Canada-Ontario Great Lakes Water Quality agreements
- Water quality
- Floods
- Preparation of responses to International Joint Commission reports
- Coordination of federal activities in the Mackenzie River basin.

In addition to the work of these subcommittees, issues or topics of interest brought to the attention of ICW over the past year included:

- Activities related to the development of the Federal Water Policy
- The Canada-Ontario response to the third biennial report of the International Joint Commission
- The review of the Canada-U.S. Great Lakes Water Quality Agreement
- Great Lakes Remedial Action Plans
- The Science Council of Canada study of water research.

FEDERAL-PROVINCIAL WATER RESOURCE MANAGEMENT PROGRAMS

Table 1 shows a breakdown of current cost-shared federal-provincial water management programs and indicates the stage each has reached. Each of the programs is referred to briefly in the following few pages and described in more detail later in this report. Table 2 is a record of the achievements under the Act since its inception in 1970.

Table 1. Status of Federal and Federal-Provincial Water Management Programs

Regulation, Apportionment, Monitoring and Survey Programs		
<u>Under Negotiation</u>	<u>New During 1987-88</u>	<u>Ongoing During 1987-88</u>
Water quality monitoring agreements with Saskatchewan, Prince Edward Island, Manitoba, New Brunswick, Ontario, Northwest Territories and Yukon		Water quantity surveys with all provinces Prairie Provinces Water Board Mackenzie River Basin Committee Water quality monitoring agreements with Quebec, British Columbia and Newfoundland Lake of the Woods Control Board* Ottawa River Regulation Planning Board Ottawa River Water Quality Coordinating Committee
Water Management Programs		
<u>Under Negotiation</u>	<u>New During 1987-88</u>	<u>Ongoing During 1987-88</u>
Yukon River Basin Implementation Agreement Mackenzie River Basin General Agreement	Studies on Water Resource Management for Economic Development in Prince Edward Island	South Saskatchewan River Basin Study Saskatchewan Irrigation Development† Lower Fraser Valley Flood Control Canada-Ontario Agreement on Great Lakes Water Quality Qu'Appelle Conveyance Channel - Port aux Basques Water Improvements† Fraser River Estuary Management Program
Flood Damage Reduction Program		
<u>Under Negotiation</u>	<u>New During 1987-88</u>	<u>Ongoing During 1987-88</u>
Initial agreements with Alberta and Yukon Territory Extension of Mille Iles Flood Control Agreement	Amending agreements with Newfoundland and New Brunswick Initial agreement with British Columbia Amendment of General/Mapping agreements with Quebec and Northwest Territories Amendment of Manitoba Flood Forecasting Agreement	General/mapping agreements with New Brunswick, Newfoundland, Nova Scotia, Quebec, Ontario,‡ Manitoba and Saskatchewan Flood Forecasting agreements with New Brunswick and Manitoba Memorandum of Understanding on Indian Lands Manitoba Flood Protection Projects Studies agreements with New Brunswick, Newfoundland, Nova Scotia, Manitoba and Saskatchewan Agreement with Saskatchewan on Community Floodplain Management Measures

* Established under the Lake of the Woods Control Board Act.

† Not a Canada Water Act agreement but included here in the interest of completeness. Special funds were made available for this project under Economic and Regional Development Sub-Agreements.

‡ Flood Damage Reduction Agreement with Ontario includes a component for other measures.

Note: For convenience of presentation, some agreements have been separated into categories (general, mapping, studies). Often, they are combined.

Table 2. Programs or Studies Completed under the Canada Water Act

Peace-Athabasca Delta Planning	1972
Qu'Appelle River Basin Planning	1972
Saskatchewan-Nelson Basin Planning	1973
Okanagan Basin Planning	1974
Saint John Basin Planning	1975
Lake Winnipeg, Churchill and Nelson Rivers Planning	1975
Great Lakes Shore Damage Survey	1975
Fraser River Upstream Storage Planning	1976
Churchill River Basin Planning (Sask.-Man.)	1976
Montreal Region Flow Regulation Planning Study	1976
Peace-Athabasca Delta Implementation	1976
Northern Ontario Water Resources Planning	1978
Southeastern New Brunswick Dyking Implementation	1978
St. Lawrence Water Quality Planning Study	1978
Souris Basin Planning	1978
Metropolitan Toronto Flood Control Implementation	1978
Lower Saskatchewan Basin Preplanning	1979
Southwestern Ontario Dyking Implementation	1979
Upper Thames Flood Control Implementation	1979
Yukon Basin Preplanning	1979
Ottawa River Regulation Planning Report	1980
Thompson Basin Preplanning	1981
Great Lakes Shore Damage Survey Implementation	1981
Dykes and Flow Regulation Works - Montreal Region	1981
Mackenzie Basin Planning	1982
Shubenacadie-Stewiacke Basin Planning	1982
Ottawa River Water Quality Report	1982
Okanagan Basin Implementation	1982
Prairie Provinces Water Board Water Demand Study	1983
North Shore (St. Lawrence) Ecological Inventories	1983
Winter River Preplanning	1983
Wabigoon-English Mercury Contamination Study	1984
Flood Prevention within the City of Quebec	1984
Fraser River Estuary Planning	1984
Studies and Implementation of Dykes and Flow Regulation Works - Montreal Region	1984
Waterford Urban Hydrology Study	1985
Yukon River Basin Planning	1986
Mercury in Churchill River Diversion System	1986
Winter River Basin Planning	1987
Flood Damage Reduction in the Town of Richmond (Quebec)	1987

Regulation, Apportionment, Monitoring and Survey Programs

Although most federal-provincial agreements carry a time limit within which the objectives of the agreement are likely to be reached, there are some agreements involving monitoring and survey responsibilities that are projected to continue into the foreseeable future without termination.

Water Quantity Data Collection

The federal government has been involved in the collection of water quantity data since the late 1800s. In earlier years, hydrometric networks were operated under informal arrangements with all of the provinces except Quebec. The 1922 Agreement with Quebec was rescinded in 1964 when the Quebec government took responsibility for most of the hydrometric network in that province. Beginning in April 1975, uniform cost-sharing Water Quantity Survey agreements were implemented with all provinces and Memoranda of Agreement with the Department of Indian and Northern Affairs for the territories.

The agreements recognize that water quantity data may be collected to meet federal interests, provincial interests, or a combination of both. Hence funding for the operation of the networks is provided according to each party's needs. The water quantity networks and cost-sharing data are determined annually by federal-provincial coordinating committees. Also, a national meeting of all federal-provincial coordinating committees is convened periodically to review annual progress reports and to discuss any concerns arising under the agreements.

During the year, a total of 2973 gauging stations were operated under the agreements in Canada, 2609 by the federal government and 364 by the province of Quebec. Data from these stations as well as from 485 stations operated mainly by other provincial agencies are contained in the national water data bank - HYDAT; the data bank also contains data for another 4119 discontinued stations.

Under the terms of the agreements, Canada is responsible for maintaining the computer database and for publishing the data. Water

quantity data are essential to good water management and for the design and operation of bridges, dams, and drainage and water supply works across the country. Since the costs of collecting water data are substantial, the efficiency of data collection programs is enhanced significantly by planning networks, by using standardized methodology, and by providing interpretative information that facilitates the application of the data collected. To ensure that the data provided to the user are of the highest quality and precision, a quality assurance program is being implemented to monitor methods and procedures in field surveys and office automated computations to established national standards.

DCP Network

In a move to improve upon data collection associated with the hydrometric survey, a five-year program to acquire and install data collection platforms (DCPs) at remote hydrometric sites across Canada received Treasury Board approval effective April 1, 1983. Through the use of satellites, the DCP permits the real-time acquisition of hydrometric data. Effectiveness of operation and cost savings were key items in the original proposal, with the output of greatest value to navigation, reservoir operation, water allocation, flood forecasting and similar purposes. When necessary, DCPs are being equipped with sensors to provide information required by the Atmospheric Environment Service and other agencies. As of March 31, 1988, 390 active DCPs were in operation; by the end of 1988, the active total is expected to increase to about 450.

Currently, data from the DCP network are being retrieved from a U.S. receive station via an automatic dial-up system. The establishment of ground receive stations in Canada, in cooperation with the Atmospheric Environment Service, is under way. The system, which has three sites, is expected to be in operation in 1988-89. Installation of these facilities will greatly improve the efficiency of distributing real-time data required for network operations.

Water Quality Monitoring Agreements

Environment Canada has been negotiating water quality monitoring agreements with interested

provinces to provide for sharing of costs, exchange of data and a Canada-wide quality control program. To date, agreements have been signed with Quebec, British Columbia and Newfoundland; an agreement with Alberta has been postponed; negotiations for agreements with Manitoba, Saskatchewan, New Brunswick, Ontario, Prince Edward Island and with the Yukon and the Northwest Territories are progressing; and negotiations have begun with Nova Scotia. If all provinces join the program, the new network is expected to incorporate 450 existing stations of federal interest, upwards of 2000 existing stations of provincial interest, and about 180 new stations of joint interest. In addition, some agreements may include cost-shared surveys or special studies to best address existing or emerging issues of joint concern. The proposed stations exclude Great Lakes water quality stations which are administered under other agreements. In March 1983, Treasury Board approved the resources required to implement the agreements in all of the provinces. The Yukon and Northwest Territories require separate funding.

Prairie Provinces Water Board

The Prairie Provinces Water Board, a federal-provincial board which administers the Prairie Provinces Master Agreement on Apportionment, continued to provide recommendations to Canada, Alberta, Saskatchewan, and Manitoba concerning the equitable apportionment of eastward flowing interprovincial prairie rivers. During the year, the Board's Committee on Hydrology continued to recommend procedures for natural flow determination for apportionment purposes and for evaluating the effect that proposed projects might have on the balance of interprovincial waters. In addition, the Board's Committees on Water Quality and Ground-Water provided technical advice on interprovincial water quality and ground water matters. A four-year study of historic and current water demands in the three prairie provinces was completed in December 1982 and that information is now being updated on a continuous basis. The Board also has approved the report on Administration of the Apportionment Agreement and has implemented the recommendations on apportionment of the flow of Battle, Lodge and Middle creeks at the Alberta-Saskatchewan boundary.

Mackenzie River Basin Committee

The Mackenzie River Basin Committee, with representation from Canada, Alberta, Saskatchewan, British Columbia and Yukon and Northwest Territories, met twice during the year to fulfill its liaison and ongoing information exchange responsibilities. The Committee has recommended a general agreement that will supersede the 1977 Memorandum of Understanding which formed the Committee; the new agreement would reconstitute the Committee, and give full member status to the Northwest Territories and Yukon Territory.

Ottawa River Regulation Planning Board

The Ottawa River Regulation Planning Board has a mandate to plan and recommend criteria for regulating the Ottawa River, taking into account hydropower production, flood protection, navigation, low water problems, water quality needs, and recreation. Studies are under way to develop risk management methodology for the Ottawa River basin and to assess the impacts of using flood reserves for the operation of the Mille Iles dam.

Ottawa River Water Quality Coordinating Committee

The Ottawa River Water Quality Coordinating Committee was established early in 1983 to be responsible for reviewing data needs and for coordinating data collection through a joint monitoring program. The Board's first annual report contained an analysis of monitoring data from the past several years. The report noted some improvement in water quality in the river. A second report is in preparation.

Garrison Diversion Studies

In support of the Department's monitoring of the Garrison Diversion Unit in North Dakota, the Water Planning and Management Branch, Inland Waters Directorate, reviewed three reports to identify Canadian concerns. The reports included the U.S. Bureau of Reclamation's report entitled "Water Supply and Delivery System Study - Southern McClean and Sheridan Counties," and the North Dakota State Water Commission's reports "Devils Lake Outlet Committees' Final Recommendations" and "Mid Dakota Reservoir Development Plan." This

information is being used by External Affairs in its continuing Canada-United States dialogue on the Garrison irrigation project.

Lake of the Woods Control Board

The Lake of the Woods Control Board continued to regulate certain waterways in the Winnipeg River basin to balance the requirements of the various and sometimes conflicting interests that depend on the water in the basin. The Board was established under the Lake of the Woods Control Board Act, well before the Canada Water Act was passed, and is described here only to complete the picture on federal-provincial water management in Canada.

Water Management Programs

Depending upon the nature of the work being conducted, water management programs can fall within any of the three stages - preplanning studies, planning studies or implementation activities. During 1987-88, several water management programs were continued, and a work-sharing arrangement was initiated for water resource management and development studies in Prince Edward Island.

Preplanning Studies: Preplanning studies are normally done as a result of public representation to resolve one or more problems perceived at the local level. The preplanning study has become the vehicle with which to investigate the concerns expressed. In this type of study all of the emerging and potential opportunities and problems of the area in question are examined and recommendations concerning the desirability of a longer-term planning study are made.

In October 1987, a work-sharing arrangement between Environment Canada and the Prince Edward Island Department of Community and Cultural Affairs was concluded respecting the conduct of Studies on Water Resources Management For Economic Development. This is a three-year project coordinated by a federal-provincial committee, with each party contributing \$500 000 worth of work. The studies include special surveys and demonstration projects related to ground water resources, inland surface water resources, estuarine water resources, and multi-sectoral and integrated water management. A final report is scheduled for September 1990.

In 1987, a study was initiated for the Yellowknife River basin with a completion date scheduled for July 1988. The purpose of the study is to compile the water resource, geophysical and socio-economic information available for the basin. The study should develop recommendations for future water resource data collection programs and should identify water management issues in the basin. The feasibility of conducting a more comprehensive study is being assessed with other water management agencies in the Northwest Territories.

Planning Studies: A preplanning study may or may not be followed by a planning study. Planning studies generally are directed toward the development or management of the water resources for the social betterment and economic growth of the basin or area under study. In May 1986, the Canada-Saskatchewan River Basin Study Agreement was signed to develop a framework plan to guide future water development in the basin. The plan will assess the impacts of future growth and ensure that the basin's limited supplies of water can meet the needs of the range of uses. A final report is scheduled for December 1989.

During 1987-88 a number of important baseline studies were completed to document water quality, supply, and use data and catalogue water development proposals. Analytical tools such as water quantity simulation, water use, hydroelectric power, and water quality restraint simulation models were also under development during the year. Further refinement and application to the evaluation of water management alternatives, including water conservation and development, are planned for 1988-89.

In its final study report, which was released on March 26, 1986, the Yukon River Basin Committee's main recommendation was that a formal agreement be established to develop a framework for water resource planning and coordinate ongoing water planning and management activities in the Yukon River basin. During 1987-88, a working group met to review the status of water and related resource activities in the basin and developed a draft intergovernmental agreement, for the consideration of the parties, to implement the study recommendations.

Canada, Manitoba, Manitoba Hydro, and the Northern Flood Committee, which comprises the five Indian Bands of Cross Lake, Nelson House, Norway House, Split Lake and York Landing, signed the Northern Flood Agreement in December 1977. This agreement, which is not under the Canada Water Act, is administered federally by the Department of Indian and Northern Affairs to provide compensation for the effects of Nelson River hydropower developments, specifically Lake Winnipeg regulation and the Churchill River diversion. It also provides an opportunity for renewed economic and social development in the communities. Article 17 of the agreement commits Canada, Manitoba, and Manitoba Hydro (1) to joint action for the implementation of the recommendations of the Lake Winnipeg, Churchill and Nelson Rivers Study Board Report, which deals with ecological concerns, and (2) to report annually to the Band Councils on progress made. In April 1986, Treasury Board approved \$1.76 million for Environment Canada to design and implement a five-year ecological monitoring program.

During fiscal year 1987-88, Terms of Reference for the Claim #18 Program Advisory Board and a Four-Party 1987-88 Work Plan were negotiated and signed. Under the negotiated work plan, long-term studies on water quality and quantity were implemented. The second year of a planned three-year evaluation of waterfowl populations was carried out and assessments of the effect of sediment transport of waterfowl populations were conducted. As well, assessments of sediment transport and morphological changes along the diversion route were completed. The results of five studies done in 1986-87 were published in the Northern Flood Agreement: Ecological Report Series, and given wide distribution. A framework for environmental studies for the period 1988-89 to 1990-91 was developed and submitted to the Claim #18 Program Advisory Board for discussion.

Implementation Programs: Although no new implementation agreements were initiated in 1987-88, several programs continued owing to agreements in earlier years, including a renewed Canada-Ontario Agreement on Great Lakes Water Quality which extends to March 31, 1990. This agreement provides for the cost-sharing of surveillance, upgraded sewage treatment and phosphorus control and reflects the commitments undertaken by Canada in the 1978 Canada-U.S.

Great Lakes Water Quality Agreement. It also re-emphasizes the cooperative phosphorus control and Great Lakes surveillance programs and, in accordance with the 1978 Agreement, outlines programs for dealing with toxic substances and hazardous materials in the Great Lakes. On October 16, 1983, Canada and the United States signed a supplement to the 1978 Agreement for the purpose of lowering phosphate levels in Great Lakes waters. On November 18, 1987, the parties signed a Protocol amending the 1978 Agreement for the purpose of strengthening programs concerning all sources of toxic substances entering the Great Lakes ecosystem.

An Agreement respecting a Fraser River Estuary Program was signed in October 1985 by Environment Canada, the Department of Environment for British Columbia, Fisheries and Oceans Canada, the Fraser River Harbour Commission, and the North Fraser Harbour Commission. To cost \$1 250 000 over five years, the program is based on a study conducted between 1977 and 1982. Well into its third year of operation, the program is designed to guide economic development while protecting the environment of the estuary.

To improve the water of the Town of Channel-Port aux Basques, the Newfoundland and federal governments signed an Economic and Regional Development (ERDA) Sub-Agreement on July 31, 1985, under which the federal government was to provide a maximum of \$6.5 million or 90% of costs (which ever is less) toward the \$7.222 million agreement. Under this agreement, work was completed on a water treatment system. The plant was commissioned in March of 1988.

To complete the conveyance work begun under the 1974-1984 Qu'Appelle Implementation Agreement, the Qu'Appelle Conveyance Agreement was signed by Canada and Saskatchewan in June 1984. Extending to March 31, 1989, the \$4.75 million agreement is cost-shared equally by the two governments. The program is designed to improve the channel carrying capacity in restricted areas of the river. When completed, the improved channel will convey larger quantities of water with less overbank flooding. During 1987-88, channel improvements were completed in the reach between Highway No. 6 and Pasqua Lake.

The Peace-Athabasca Delta Implementation Committee in 1987 completed an evaluation of the performance of remedial weirs constructed in the delta on the outlet channels of Lake Athabasca. The two weirs had been constructed in 1976 as a major part of an implementation agreement between the governments of Canada, Alberta and Saskatchewan, to restore water levels in the delta and to mitigate the adverse impact that regulation of the Peace River has had on the delta regime. The Committee concluded that the weirs have performed as predicted, largely restoring the delta to natural conditions.

The Canada-British Columbia Fraser River Flood Control program, designed to reduce damages due to floods in the lower Fraser Valley and other areas upstream in British Columbia, continued during the year. Some \$129 million of a total joint commitment of \$161 million was spent to the end of March 1988.

Early in 1988, a one-time contribution was made to the Government of Quebec to defray a portion of the costs of decontaminating the Caniapiscou River in September of 1984. The pollution threat resulted from the drowning of some 10 000 caribou during their annual migration. An agreement was negotiated for the payment, following an offer made by the Minister of the Environment, on behalf of the Prime Minister, to contribute \$75 000 toward the cost of the cleanup.

Flood Damage Reduction Program

During 1987-88, this program was active throughout most of Canada.

Objective: The Flood Damage Reduction (FDR) Program follows the cooperative federal-provincial approach of the Canada Water Act. Its overall aim is to reduce flood damages. The first step is to identify flood risk areas and discourage further flood vulnerable developments in those areas. Where existing development warrants it, a second step may be to provide remedial measures.

When joining the program, the provinces sign a General Agreement and a Mapping Agreement (or a combined agreement). The General Agreement outlines the basic approach that will be taken to reduce flood damages. The respective

governments and their agencies agree not to engage in, or provide assistance to undertakings vulnerable to flood damage in designated flood risk areas. In such areas, federal disaster assistance will be restricted to structures built before designation and, in some circumstances, new structures which are flood-proofed. Zoning on the basis of the flood risk is encouraged.

The Mapping Agreement provides for the flood risk mapping and designation of the areas to which the policies in the General Agreement will apply. Forming part of this agreement is a list of communities in the province which are to be mapped and specifications to be followed in conducting the hydrotechnical and mapping work. When maps not meeting these specifications are available, interim designation may be applied until such time as new maps are prepared. This agreement also requires that information pertaining to the designated area be made available to governments, zoning authorities, the public, and anyone contemplating development in or near these areas. As a matter of course all flood risk maps and reports are distributed to key federal departments represented on the Treasury Board Advisory Committee on Federal Land Management and to a number of federal departments whose programs could be affected by FDR Program designations. Designations to March 31, 1988, are listed in Table 3.

In some cases existing developments in designated areas will still require protection against flood damages and, for this reason, additional agreements to study such problems can also be negotiated with the provinces. Where benefits exceed costs and where there is a national interest, federal-provincial agreements may subsequently be reached on implementation action. This action could include flood forecasting and warning, flood proofing, works to control flows and levels, acquisition of property, easements or land use planning. It should be noted that in examining alternatives, the best choice will be made on the basis of effectiveness, cost, and environmental impact. This could mean allowing some flooding to occur.

Duration: The original agreements generally covered a ten-year period, but an Amending Agreement in 1980-81 extended the General

Agreement with Manitoba beyond the ten-year period. Similar extensions occurred in 1981-82 with the signing of an Amending Agreement with New Brunswick and in 1982-83 with the signing of an Amending Agreement with Ontario. In 1983-84, a Studies Agreement was signed with Newfoundland. As well, in 1983-84, the General and Mapping agreements with Newfoundland, the Mapping Agreement with Quebec and the Flood Forecasting Agreement with Manitoba were amended. In 1984-85, the General, Mapping, and Studies agreements with Nova Scotia were amended. In 1985-86, the Mapping Agreement with Ontario and the General, Mapping, Studies, and Ring Dyke Upgrading (now Construction of Flood Protection Projects) agreements with Manitoba were amended. In 1986-87, the General Agreement with Saskatchewan was amended while new Mapping, Studies and Community Flood Plain Management Measures agreements with Saskatchewan were signed.

The following activities with respect to agreements took place in 1987-88:

- A Floodplain Agreement was concluded with British Columbia
- The Flood Forecasting Agreement with Manitoba was amended
- The combined General/Mapping Agreement with Quebec was renewed with amendments
- Amendments to the General and Flood Forecasting agreements with New Brunswick and a new Studies and Mapping Agreement were negotiated
- Amendments to the Newfoundland General Agreement and the Studies and Mapping agreements were negotiated.

Participants and Funding: Canada and the provinces share the costs (see Table 4).

Related Agreements: Several ongoing studies and implementation agreements dealing with flood prone areas in Canada were in force when the Flood Damage Reduction Program was launched. Only one such agreement remains; it is described elsewhere in this report in the section on federal-provincial cooperative agreements under the title "The Fraser River Flood Control Program."

Report on Progress

Proposed amendments are discussed in following sections.

Newfoundland

The Deer Lake area was designated on March 15, 1988, raising to seven the number of designations in Newfoundland. In October 1987, a public meeting was held at which implications of the designation process were discussed.

Hydrotechnical work is under way toward designation of areas in Cox's Cove, in Parson's Pond, along the Waterford River, and in the Stephenville Crossing/Black Duck area. Base maps have been completed for Glovertown, Glenwood, and Appleton.

Terms of Reference are being prepared for the Codroy Valley hydrotechnical studies. Work was begun on a hydrotechnical study for Bishop's Falls.

Extensions of the Newfoundland General Agreement and the Studies and Mapping agreements were negotiated.

Nova Scotia

The floodplain in the vicinity of the Little Sackville River was designated on May 29, 1987. The Truro and area floodplain was designated on March 31, 1988.

Base maps have been completed and some field work has been undertaken in the Kentville area. A decision to pursue further the preparation of flood risk maps is pending. A remedial study had previously been completed of the Mill Brook area of Kentville.

New Brunswick

The Mapping and Studies agreements expired on March 31, 1986, and the Flood Forecasting Agreement, on March 31, 1987. During 1987-88, the federal and provincial governments negotiated the extension of the General Agreement, the Flood Forecasting Agreement as well as a new combined Studies and Mapping Agreement. Federal support for the Saint John River Flood Forecasting Centre will be phased out over the five-year life of the amended Agreement.

Ice jams sent heavy snowmelt runoff over the banks of the Saint John River and its tributaries from March 31 through April 6, 1987. Hundreds of families were forced to evacuate

their homes, with the hardest hit community being Perth-Andover. The rampaging flood waters sent huge chunks of ice through the streets, swept away the C.P. railway bridge and 17 rail cars. A second railway bridge near Woodstock was also damaged. The flooding also forced closure of sections of the Trans-Canada Highway and threatened riverside residences in Fredericton.

Quebec

Work under the Canada-Quebec Agreement respecting flood damage reduction on the Saint-François River within the limits of the Town of Richmond was completed during 1986-87 at a total cost of \$3.7 million, of which the federal share was \$1.7 million.

Construction of the Grand Moulin dam was completed in 1986 under the Agreement respecting flood damage reduction on the Mille Iles River. The ministers agreed, through an exchange of letters dated August 15, 1985, to reallocate funds provided for in the agreement in order to increase funding for studies from \$30 000 to \$230 000. These funds are being used to finance studies aimed at increasing the operating capabilities of the control structure by improving the regulation of some reservoirs on the Ottawa River. At the request of the Government of Quebec, Treasury Board agreed in September 1987 to extend the agreement until March 31, 1989, in order to complete the studies and implement works to raise certain streets in the city of Laval near the dam. As of March 31, 1988, the province of Quebec had not obtained its authority for the extension.

The new agreement concerning mapping and floodplain protection was signed on June 25, 1987. The termination date for the mapping component of this agreement will be March 31, 1992; the implementation of the intervention policy concerning flood risk areas designated on a final or an interim basis will come to an end on March 31, 1997. A total of \$4 800 000 in new resources will be required, each party contributing 50% of the cost. Official exceptions and derogations are provided for exceptional cases and only for certain categories of works identified in the agreement (particular requests concerning municipal facilities among others).

Under the initial agreement, 12 designations were made concerning flood risk areas of 185 municipalities. The number of municipalities listed in Schedule A of the new agreement has increased considerably and totals more than 500, with some appearing on more than one body of water. Hydraulic and hydrologic studies continued, but no designation took place during 1987-88.

Ontario

During 1987-88, the Canada/Ontario FDR Program funded 27 projects. Of these, 23 were for flood risk mapping.

The Steering Committee recommended and the ministers agreed to designate flood risk areas in Kingston, Dresden, Belleville, Foxboro, Espanola, Thessalon, Searchmont, New Hamburg, Drayton, and Ayr.

To date, there have been 20 designations, involving 81 communities and 76 public information map sheets. Currently, work is in progress on behalf of 26 Conservation Authorities and 10 municipalities where no Conservation Authority exists.

The program completed two regional hydrology studies on the Nottawasaga and Muskoka watersheds. These studies are providing design flows for floodline mapping at five locations in the Nottawasaga Basin and three sites on the Muskoka system.

Two major studies were completed which will improve flood forecasting on Ontario's water courses. The Antecedent Precipitation Index Study addressed the computation of the volume of precipitation available for runoff. The categorization of watersheds for the Operational Flood Forecasting Study will assist Conservation Authorities in selecting and implementing appropriate flood forecasting systems.

In light of serious flooding and erosion on the Great Lakes shoreline, the mapping of these shorelines has become a high priority for the program. Horizontal control surveys were completed for 800 kilometres of shoreline, covering damage prone areas on lakes Ontario, Erie, St. Clair, and Huron. Early next year,

Table 3. Designations to March 31, 1988, under the Flood Damage Reduction Program

Location	Number of Communities Mapped	Number of Public Information Maps	Date of Designation
Newfoundland			
Stephenville*	2	1	June 1984
Steady Brook*	2	1	March 1985
Placentia*	2	1	March 1986
Badger	1	1	March 1986
Rushy Pond	1	1	March 1986
Rushoon	1	1	February 1987
Deer Lake*	4	1	March 1988
7 designations	13	7	
Nova Scotia			
East River*	5	1	February 1984
Sackville River*	3	1	February 1984
Antigonish*	2	1	November 1984
Little Sackville River*	3	1	May 1987
Truro*	8	1	March 1988
5 designations	21	5	
New Brunswick			
Fredericton*	10	1	February 1980
Perth/Andover	2	1	February 1980
Oromocto to Lower Jemseg*	16	1	March 1981
Lower Fredericton to Lincoln*	3	1	February 1982
Sussex*	15	1	September 1982
Keswick*	5	1	March 1983
Norton*	2	1	May 1985
Walker Brook*	2	1	March 1986
8 designations	55	8	
Quebec			
Montréal Region*	38	22	May 1978
Chaudière Basin*	19	8	March 1979
Gatineau/Ottawa rivers*	19	15	October 1979
Haut-Richelieu/ Baie Missisquoi*	19	11	April 1980
Rivière du Gouffre*	4	2	April 1980
Bas-Richelieu*	23	10	November 1981
Rivière L'Assomption*	12	4	May 1982
Rivière Saint-François*	14	6	October 1982
Rivière Yamaska*	22	12	June 1983
Rivière Bécancour*	4	2	May 1984
Rivière Nicolet*	10	3	May 1984
Trois-Rivières-Ouest	1	5	August 1984
12 designations	185	100	

*These designations are on a regional or river basin basis and cover a number of municipalities or parts of municipalities.

Table 3. Continued

Location	Number of Communities Mapped	Number of Public Information Maps	Date of Designation
Ontario			
White River	1	1	August 1982
Toronto*	24	8	December 1982
Sturgeon River/Lake Nipissing/ French River*	9	5	March 1983
Kaministiquia River*	2	1	August 1983
Nipigon	1	1	March 1986
Atikokan	1	1	March 1986
Grand River*	4	2	March 1987
Maitland Valley*	4	2	March 1987
Nickel District*	5	33	March 1987
Otonabee Region*	2	2	March 1987
Lower Trent Region*	12	8	March 1987
Goulais River	4	1	August 1987
Espanola	1	1	August 1987
Thessalon	1	1	August 1987
Little Cataraqui Creek (Kingston)	2	1	March 1988
Bell Creek (Belleville)	1	1	March 1988
Moir River*	2	3	March 1988
Nith River*	3	2	March 1988
Conestogo River*	1	1	March 1988
Dresden	1	1	March 1988
20 designations	81	76	
Manitoba			
Melita	1	1	December 1979
Wawanesa	1	1	December 1979
Winnipeg	1	1	February 1980
Souris	1	1	October 1980
Elie	1	1	November 1980
Brandon	1	1	March 1982
La Salle - Sanford - Starbuck	3	1	November 1982
Swan River	1	1	May 1983
Dauphin	1	1	February 1984
Carman	1	1	June 1984
Lorette	1	1	September 1984
Arborg	1	1	November 1987
Fisher Branch	1	1	November 1987
Riverton	1	1	November 1987
16 designations	16	14	
Saskatchewan			
Estevan	1	1	August 1980
Oxbow	1	1	August 1980
Roche Percée	1	1	August 1980
Moose Jaw	1	1	October 1981
4 designations	4	4	
Northwest Territories			
Hay River*	2	1	May 1984
Fort Simpson	1	1	June 1985
Aklavik	1	1	June 1985
Fort McPherson	1	1	June 1985
Fort Good Hope	1	1	June 1985
Fort Liard	1	1	September 1987
Nahanni Butte	1	1	September 1987
Fort Norman	1	1	September 1987
Tuktoyaktuk	1	1	March 1988
9 designations	10	9	

Table 3. Concluded

Location	Number of Communities Mapped	Number of Public Information Maps	Date of Designation
British Columbia			
Chilliwack: Vedder Crossing to Slesse Creek	-	-	December 1987
Columbia River: Columbia- Windermere lakes	-	-	December 1987
Columbia River at Golden	-	-	December 1987
Columbia River: Windermere Lake-Radium	-	-	December 1987
Coquitlam River: Coquitlam Lake - Fraser River	-	-	December 1987
Courtenay River	-	-	December 1987
Cowichan Lake	-	-	December 1987
Cowichan and Koksilah rivers at Duncan	-	-	December 1987
Eagle River	-	-	December 1987
Elk River at Fernie	-	-	December 1987
Elk River at Sparwood	-	-	December 1987
Kitimat River	-	-	December 1987
Kootenay River: Kootenay Lake- U.S. Border	-	-	December 1987
North Thompson River: Kamloops- Vavenby	-	-	December 1987
Salmon and White rivers	-	-	December 1987
Shuswap River: Mara Lake to Mabel Lake	-	-	December 1987
Skeena River: Lakelse-Terrace-Usk	-	-	December 1987
South Thompson River: Kamloops- Chase	-	-	December 1987
Thompson River: Kamloops area	-	-	December 1987
Tulameen River: Coalmont-Tulameen	-	-	December 1987
Okanagan Lake: Westbank to Peachland	-	-	December 1987
Columbia River at Revelstoke	-	-	December 1987
Fraser and Nechako rivers: Prince George	-	-	December 1987
Kaslo River at Kaslo	-	-	December 1987
Squamish River	-	-	December 1987
Goat River	-	-	December 1987
Mission Creek	-	-	December 1987
Nanaimo River	-	-	December 1987
Nechako River at Vanderhoof	-	-	December 1987
Bulkley and Telkwa rivers	-	-	December 1987
Bulkley River at Houston	-	-	December 1987
Cheakamus River	-	-	December 1987
Zymoetz (Copper) River	-	-	December 1987
Englishman River	-	-	December 1987
Vedder River (Vedder Canal to Vedder Crossing)	-	-	December 1987
35 designations			
Total			
116 designations	385	223	

aerial photography, vertical control, and map production will be done. Design water levels were calculated for various Great Lakes shore reaches.

A survey of shore damage potential for residential structures on Lake Superior was completed. This study will provide information necessary to assess shore management alternatives; impacts from water level regulation; and areas in need of flood risk mapping.

Manitoba

The Flood Forecasting Agreement was amended on April 30, 1987, to extend the termination date of the Agreement respecting flood forecasting to September 30, 1989, with additional funding of \$400 000. A report detailing the work on Phase 1 of the agreement was completed. Preparation of a report on Phase 2 activities continues.

A Telidon weather radar system was developed in cooperation with the Atmospheric Environment Service of Environment Canada. Evaluation of the system is continuing.

Flood risk areas at Arborg, Fisher Branch and Riverton were designated effective November 5, 1987. Post-designation meetings were held at these communities to explain the purpose and impacts of designation.

Flood protection works were completed at Letellier, Brunkild, Rosenort, St. Jean Baptiste, and Morris. Public hearings were held at Ste. Rose du Lac in September 1987, to consider local opposition to the proposed project. The hearing results supported the project as initially proposed.

Negotiations are continuing with U.S. officials on a proposal for the joint construction of flood protection works for the communities of Emerson, Manitoba, and Noyes, Minnesota.

An information brochure on flood forecasting was prepared and distributed.

Saskatchewan

A new Mapping and Studies Agreement with a shared cost of \$1 million (Canada's share not to exceed \$500 000) and a Community Floodplain

Management Measures Agreement with a shared cost of \$580 000 (Canada's share not to exceed \$279 000), both with termination dates of March 31, 1992, were signed on March 4, 1987. On the same date the General Agreement was extended by approximately ten years to March 31, 1997.

Saskatchewan designations are not on schedule due to provincial fiscal restraint which preceded the full-scale implementation of the planned program for the 1987-88 fiscal year. A work program is being developed to submit designation proposals for several communities where flood hazard mapping had previously been finished.

Alberta

Negotiations were completed on a \$5.5 million, six-year Canada-Alberta Flood Risk Mapping Agreement. Previous flood risk mapping of 19 communities by Alberta Environment was reviewed and accepted. Thirty-three other communities were identified for new flood risk mapping under the proposed program. Subject to legal, departmental and Treasury Board review, the agreement is scheduled for approval and signatures by ministers in 1988-89.

British Columbia

British Columbia and Canada entered into a Floodplain Mapping Agreement on December 3, 1987. The general terms of the agreement extend until 1998, with mapping to be carried out over the first five years at a shared total cost of \$5 million. Under the agreement, 35 floodplain areas in the province, previously mapped under British Columbia's unilateral program, have been designated.

The Steering Committee approved additional maps for one area to be designated and for eight areas to be interim-designated under the program.

Northwest Territories

Ministerial correspondence, which concluded on July 28, 1987, extended the termination date of the Canada-N.W.T. Flood Damage Reduction Agreement and the appended Memorandum of Understanding (MOU) to March 31, 1993. The termination date of the mapping portion of the MOU was extended to March 31, 1988.

Table 4. Federal-Provincial Flood Damage Reduction Agreements to March 31, 1988

	Duration (years)	Total Cost* (dollars)	Expiry Date
Newfoundland			
General Agreement	14	-	1993
Flood Risk Mapping Agreement	7	1 470 000	1988
Studies Agreement	5	480 000	1988
Flood Risk Mapping and Studies Agreement	2	250 000	1990
Nova Scotia			
General Agreement	16	-	1994
Flood Risk Mapping Agreement	11	1 030 000	1989
Studies Agreement	11	670 000	1989
New Brunswick			
General Agreement	24	-	2000
Flood Risk Mapping Agreement	10	2 000 000	1986
Studies Agreement	10	200 000	1986
Flood Forecasting Agreement - Saint John River Basin	15	2 300 000	1992
Flood Damage Reduction - Marsh Creek	6.5	2 010 000(a)	1984
Petitcodiac Sea Dykes Agreement	3 months	160 000	1979
Flood Risk Mapping and Studies Agreement	5	710 000	1992
Quebec			
Flood Risk Mapping Agreement	(general 21) (mapping 16)	10 800 000	1997
Dykes and Flow Regulation Works - Montreal Region	7.5	16 056 000(b)	1984
Quebec City Flood Prevention Agreement	2	833 000(b)	1985
Mille Iles River Agreement	3.5	13 100 000(b)	1987
Saint-Francois River Agreement - Town of Richmond	3	4 350 000(b)	1987
Ontario			
Flood Damage Reduction Agreement	(general 17) (mapping 12) (other 14)	- 15 400 000 2 200 000	1995 1990 1992
Manitoba			
General Agreement	17	-	1994
Flood Risk Mapping Agreement	11	2 350 000	1988
Studies Agreement	12	310 000	1989
Flood Forecasting	8.5	1 000 000	1989
Construction of Flood Protection Projects Agreement	7	6 100 000(b)	1989
Saskatchewan			
General Agreement	20	-	1997
Flood Hazard Mapping and Studies Agreement	(mapping 5) (studies 5)	1 300 000 480 000	1982 1982
Flood Hazard Mapping and Studies	(mapping 5) (studies 5)	750 000 250 000	1992 1992
Community Floodplain Management Measures	5	580 000	1992
British Columbia			
Floodplain Mapping Agreement	(general 10) (mapping 5)	- 5 000 000	1998 1993
Northwest Territories			
Memorandum of Understanding	2	225 000(c)	1978
Memorandum of Understanding	14	400 000(c)	1993
	(mapping 9)		1988
General Agreement	14	-	1993

* These costs are to be shared equally by the federal and provincial governments except for:
 (a) 33 1/3% federal, 66 2/3% provincial/local; (b) 45% federal, 55% provincial/local; (c) costs shared equally by Environment Canada and the Department of Indian and Northern Affairs.

Fort Liard and Nahanni Butte were designated effective September 15, 1987; Fort Norman was designated on September 16, 1987; and Tuktoyaktuk was designated on an interim basis on March 31, 1988. Post-designation meetings were held in Fort Liard, Nahanni Butte, and Fort Norman.

As a result of high flood levels experienced over the past several years, FDR Program officials have decided to re-evaluate the flood levels used to designate the Hay River area in 1984. In May 1985, a major flood occurred at Hay River. An ice jam in the East Channel (main channel) and at the mouth of the West Channel caused flooding in the West Channel Village. The flood waters rose more than a metre over the flood levels used to designate the area under the FDR Program. Similar flooding occurred in 1986. The flood was expected, however, and damages were lower. A study supervised by the Steering Committee has been initiated to reconsider the ice jam flooding hazard at the town of Hay River. A draft flood forecasting sub-agreement has also been proposed to facilitate the improvement of flood forecasting capabilities for the Hay River.

Yukon

Work toward an initial agreement with Yukon was suspended pending its review of issues with respect to proposed designations in the Territory.

Indian Lands

A short enabling Memorandum of Understanding between Environment Canada and Indian and Northern Affairs Canada (INAC) was signed in May 1985, to allow interested Indian bands, with the support of regional offices in INAC, to take part in the flood risk mapping program. The work has a funding ceiling of \$300 000 per annum shared equally by the two federal departments. The program expires on March 31, 1990. Designation, which is intended to restrict flood prone development in flood risk areas, is not required.

Two Manitoba pilot projects were initiated in August 1985. These included flood risk mapping of Lizard Point and Sioux Valley Indian reserves. Criteria for selection included the severity of flooding, existing flood prone development, the need for flood risk information, availability of hydrometric data, past records, aerial photography, and other maps. The production of the topographic maps of both reserves was delayed due to the bankruptcy of the original contractor. The topographic maps finally became available in January 1987. The hydrology and hydraulic studies and flood risk mapping (eight sheets for Lizard Point and 12 sheets for Sioux Valley) showing the 1:100 and 1:500 year flood lines have been completed. The projects' costs amounted to \$116 000 (well below the budgeted \$160 000).

In Ontario, flood risk maps were completed for the Garden River and Rankin Indian reserves. A review of historical flooding of northern Ontario Indian communities was completed. Serious flood problems were documented in five coastal and three inland communities; mapping will be initiated in several of these communities in the coming year. Similar projects are under consideration in other provinces. For example, in Saskatchewan, a historical flood review will be undertaken for the Red Earth and Shoal Lake reserves. The work is scheduled to be completed in early 1988-89.

Guidelines on FDR Program

The "Federal Guidelines for the National Flood Damage Reduction Program" were prepared in 1984-85 and subsequently distributed. The guidelines are intended as the main reference for federal managers of the FDR Program and are based on the originally stated aims of the program, the experience gained, and the precedents established over the years. To the extent possible, the guidelines attempt to anticipate the program's foreseeable future needs.

WATER RESEARCH UNDER THE CANADA WATER ACT

Scientific and socio-economic research, technological development and data collection are essential tools for dealing with the increasing scope and complexity of emerging resource problems.

- Federal Water Policy

Sound management requires a thorough understanding of our water resource and its uses. Scientific research, socio-economic studies and data collection systems all provide the information necessary for good management.

Much of the federal water research is supported by Environment Canada, most of which is carried out by the Inland Waters Directorate (IWD). Here the scientific research conducted by the two IWD research institutes is summarized, highlights of socio-economic studies are presented, and activities related to water data and data management systems are described.

NATIONAL WATER RESEARCH INSTITUTE

The National Water Research Institute (NWRI) carries out water research under the Canada Water Act to advance understanding of water issues important to Canada. The knowledge and authoritative expertise developed from the Institute's research program are employed by Environment Canada to influence decisions affecting the wise management of our water resources. The Institute's role in Environment Canada is:

- To advise senior management on priority issues
- To provide leadership on rapidly developing or emerging science programs
- To represent Environment Canada in national and international water science organizations
- To provide functional guidance to operational water programs
- To provide expert spokespersons for public discussion of water science issues.

To achieve its goals, NWRI conducts a national, multidisciplinary program of targeted basic research, applied research, and experimental development in the full range of aquatic sciences, and develops research partnerships

with the Canadian and international water science communities on priority issues.

A number of initiatives have also been taken to develop and strengthen Institute linkages with universities, the private sector, the media and environmental groups, and to position the Institute for more effective intervention in the management of priority issues, both within the Department and externally on behalf of Environment Canada.

Since 1986, the research program at NWRI has been organized into projects consisting of multidisciplinary teams of scientists. Each project focuses on the development of knowledge, expertise and institutional leverage for Environment Canada on a high priority issue or need.

The projects are grouped generically under three large multidisciplinary branches - the Lakes Research Branch, the Rivers Research Branch, and the Research and Applications Branch - which are supported by centralized Research Support, Science Liaison, and Staff Support divisions.

The Institute's current research projects address eight general water research issues. Highlights of the 1987-88 research program are summarized below. In total, NWRI scientists published over 300 journal articles, research contributions and data reports on the scientific aspects of these issues in 1987-88.

Toxic Substances in the Great Lakes

A major long-term research program continued on the sources, pathways, fate and ecosystem effects of organic and inorganic contaminants, and their nearshore-offshore interactions, in the lakes and interconnecting channels of the Great Lakes - St. Lawrence River drainage basin. Current efforts are focussed on the St. Lawrence River and its riverine lakes and upper estuary.

Critical processes, such as degradation, volatilization, adsorption and bioaccumulation of contaminants are studied in relation to physical dynamics and other important limno-

logical factors. The results will be used to assess pollution impacts and the feasibility of remedial plans.

In the 1987-88 field work on the St. Lawrence River, the presence of volatile halocarbons (VHCs) was used to track contaminated river plumes between Cornwall and Quebec City. The abundance and levels of a wide variety of priority persistent organic pollutants in water, suspended sediments, bottom sediments and biota in the upper estuary were also determined.

Data on toxic trace metals (cadmium, lead, copper, nickel) along the course of the river were analyzed and evaluated; higher concentrations were found near Montreal. Physical limnological studies of salinity, temperature, turbidity and currents have revealed a possible new mechanism for contaminant recycling in the river through a tidal pumping process.

A major research program on the Niagara River - Lake Ontario system was completed this year. Field results and computer simulation models confirmed that the deposition and transport of river contaminants into the lake are controlled primarily by changes in suspended sediment concentrations, the sediment-water partition coefficients of individual contaminants, and the prevailing wind and current conditions.

The Institute also chaired a multi-agency, Canada-U.S. scientific work group that completed an interpretive evaluation of recent Niagara River monitoring data in support of the Niagara River Toxics Management Plan and the bilateral Declaration of Intent for the river.

Lake Restoration

Research is being conducted to develop expertise and practical technologies for restoring lakes from the effects of nutrient and pollution by toxic substances. Attention is currently focussed on Hamilton Harbour, which is seriously polluted and has been designated by the International Joint Commission as an Area of Concern; on small lake restoration in Western Canada; and on nutrient-contaminant interactions.

Oxygen injection to improve the water quality of Hamilton Harbour was refined and pilot-

tested for a second year. By re-oxygenating the bottom waters, heavy metals are precipitated, organic contaminants are degraded, and fish habitat is restored. Plumes of polluted harbour water were shown to enter Lake Ontario, in some cases without significant mixing in the harbour. Institute scientists also provided leadership in the analysis, interpretation and writing of the draft Remedial Action Plan for the harbour, which was released for public review this year.

In western Canada, lime treatment of eutrophic farm dugouts, previously "poisoned" with copper sulphate algicide, has proven effective in precipitating the copper along with phosphorus, sealing the sediments from further release of pollutants, and dramatically improving water quality. This work was conducted jointly with private sector researchers, and the results will be applicable to Areas of Concern in the Great Lakes.

The results of two long-term multidisciplinary field studies of lakes Erie and Ontario were reported in 1987-88. The limnological responses in the lakes to the phosphorus cleanup programs in the 1970s were examined. The Lake Ontario study established the importance of the microbial community in determining the response of the lake to phosphorus abatement. Lake Erie's response, while acceptable, was slower than expected, particularly with respect to oxygen depletion of bottom waters.

A major field program was initiated in 1987-88 to examine the relationships between trophic status (productivity) and the effects of toxic substances in lakes. Contaminant analyses were completed on zooplankton samples obtained at 28 headwater lakes in eastern Ontario and the results examined for correlations with limnological or water chemistry parameters. An inverse relationship was discovered between the productivity of the lake, as indicated by spring total phosphorus, and the total polychlorinated biphenyl (PCB) concentration in the zooplankton. Thus the vulnerability of lake biota to toxic substances appears to increase as lake productivity decreases. If this is confirmed, then continuing reductions in phosphorus loadings to the Great Lakes, for instance, may increase exposure of fish and other biota to contaminants already in the system.

Experimental studies in lakes, lake enclosures and microcosms were begun to determine the underlying causes of this relationship. Emphasis will be given to the processes of bioaccumulation, degradation and sedimentation of organic material and contaminants.

Contaminated Sediments

Previously contaminated bottom sediments are a major source of toxic substances to the overlying waters and biota of lakes. Research is being conducted on the composition and distribution of toxic substances in sediments, and on the physical and biogeochemical processes controlling lake sediment-water interactions. The focus is on sediment deposition and resuspension, chemical release rates, microbial degradation, and biotoxicity. Ongoing results will be used for evaluating remediation options in specific areas of concern in the Great Lakes and elsewhere.

The composition and levels of polycyclic hydrocarbons (a poorly understood group of persistent toxic pollutants) in sediments from different geographic areas in the Great Lakes were surveyed. Composition varied widely from site to site, suggesting specific and often local sources of the contaminants.

Oligochaete worms are often the only benthic fauna that persist in contaminated sediments and are thus a potential source of contaminants to fish if they incorporate the toxics. Laboratory and field experiments confirmed that the worms are capable of taking up and retaining DDE (1,1-dichloro-2,2-bis(p-chlorophenyl) ethylene), HCB (hexachlorobenzene), and PCBs. Models to predict uptake rates were developed.

A number of physico-chemical studies on the transport and sedimentation of contaminated fine-grain sediments in lakes Erie and St. Clair were also completed.

Ground Water Contamination

Ground water research at NWRI focuses on the physical and chemical processes controlling the migration, fate and effects of toxic contaminants in subsurface sedimentary rock aquifers, primarily in eastern and central Canada. Results are used to improve both general and site-specific protocols for aquifer

monitoring and decontamination and to develop waste-site rehabilitation plans. The current focus is on transboundary problems in the St. Clair and Niagara rivers and on the use of aldicarb, a potato-farming pesticide, in Prince Edward Island.

In joint hydrogeological studies with the U.S. Geological Survey, mapping is being done of the overall ground water flow pattern in the Niagara frontier. Preliminary results indicate that the low permeability sandstones and shales are preventing large-volume discharges of ground water to the Niagara River.

In Prince Edward Island, field results suggest that the low ground water pH, which is thought to inhibit the normally rapid breakdown of aldicarb, is caused by the degradation of nitrogen fertilizers used on the potato fields. This problem could be avoided if the insecticide was applied following plant emergence in late June rather than early spring.

Additional studies were completed on hydrogeological methods for fractured rocks, on ground water contaminants in the St. Clair River basin, on aquifer restoration at the Gloucester landfill near Ottawa, and on radionuclide transport processes in sand aquifers. Extensive expert advice was also provided to U.S. and Canadian agencies concerning ground water issues.

Pesticide Assessment

NWRI pesticide research contributes to the development of new analytical methods and knowledge on the occurrence, persistence, fate, and ecotoxicological effects of pesticides in lakes and rivers. Increasing emphasis is being placed on community and ecosystem level effects. The information and expertise are used to advise Environment Canada, Agriculture Canada, and other federal agencies concerned with pesticide registration, impact assessment, water quality objectives, and environmental surveillance.

In 1987-88, pesticide studies were carried out in several locations across Canada. Previous research on tributyltin (TBT), an extremely toxic compound used as an antifouling agent in marine paints, showed it to be moderately

persistent and present in sufficiently high concentrations to affect sensitive freshwater organisms. Because of these results, Agriculture Canada, which administers the Pest Control Products Act, imposed a limited ban this year on the use of such paints containing TBT.

In Prince Edward Island, experimental field treatments showed that deltamethrin, an extremely powerful insecticide, was quickly degraded by sunlight or converted to low toxicity isomers. Its half-life in water is only about one hour.

Acid Rain

NWRI research on acid rain focuses on the development of knowledge required for federal policy formulation. Current priorities relate to the upcoming National LRTAP Assessment due in early 1990 and include:

- Evaluation of critical watershed acidification and recovery processes (based on field results from the Turkey Lakes Watershed Study)
- Spatial/temporal definition of aquatic resources-at-risk
- Review of U.S. predictive models and development of Canadian alternatives
- Scientific assessment of the national acid rain monitoring program.

Interpretive overviews on the aquatic biogeochemistry of the Turkey Lakes Watershed, predictive acid rain modelling, chemical mass balances, aluminum geochemistry, and the processes controlling hydrological and chemical fluxes during spring melt were published this year in a special volume of the *Canadian Journal of Fisheries and Aquatic Sciences* and presented at several international meetings.

Field and laboratory experiments showed that bacterial assimilation of sulphate in acid-stressed lakes results in alkalinity generation in sediments that can serve, in some situations, as an important *in situ* rejuvenation process.

In a major discovery, dimethyl sulphide (DMS) was shown to be produced and released in large amounts from bogs, marshes and wetlands. DMS may contribute up to 20% of the airborne sulphur in remote areas.

An improved method was developed to evaluate aquatic resources at risk using terrestrial data where aquatic data are inadequate.

In southern Quebec, about 4% of lakes are in critical condition and 48% are in a sensitive and susceptible condition. In the Maritimes, refinements to the RAISON model, a microcomputer-based expert system, and the development of a three-soil layer model for the Mersey River and North East Pond River basins were also completed.

Air-Water Interactions

Evidence is mounting that pollutants in the atmosphere are evoking major changes in climate and that the atmosphere is a major source of toxic substances to Canada's lakes, in particular, the Great Lakes. The expanding air-water research program at NWRI is investigating the processes controlling the rates of deposition from, and volatilization to, the atmosphere of persistent organic substances and is also evaluating the effects of long-term climate change on the physics and, eventually, the water quality of the Great Lakes.

Extensive new monitoring data on the levels of organochlorine pesticides, PCBs and chlorobenzenes in rain from across Canada clearly demonstrate that long-range transport is involved in their dissemination. A prototype all-weather sampler was tested, which is designed to capture snow as well as rain, serve as a rainfall/snowmelt gauge and concentrate contaminant samples *in situ* on resin columns.

A new, closed, recirculating wind/water tunnel and flume with a hydraulic wave maker was designed; construction is 70% complete. This unique system will be used to quantify and model the air-water exchange of toxic gases and will be equipped with sophisticated physical and sampling instrumentation.

Atmospheric deposition and fate of contaminants is also being studied in a series of remote lakes (in the Great Lakes basin) that only receive contaminants from the atmosphere. Such lakes will serve as controls for future comparisons to the Great Lakes themselves.

Plans were finalized for establishment of a

master research and monitoring station at Point Petre on the northeast shore of Lake Ontario, where a number of agencies will work collaboratively to develop better methods to measure atmospheric deposition.

Experiments on the levels of organic contaminants in the surface microlayer of lakes and rivers (e.g. the Niagara River) showed that PCBs, chlorobenzenes and chlorinated pesticides are concentrated as much as 35-fold in the microlayer relative to subsurface waters. This process has major implications for the measurement of air-water exchange processes.

Analysis of radionuclide measurements from the Chernobyl nuclear accident, obtained from rainwater and lake samples across Canada, was completed. Radioactivity reached Canada from both the west and the north and in four distinct episodes. Concentrations were too low to pose an environmental health concern.

Aquatic Assessment and Modelling

Improvements in aquatic surveillance, monitoring and assessment programs within Environment Canada are critically dependent on new methods, instruments, protocols and predictive simulation models. A number of major NWRI projects serve this broad operational need and, at the same time, contribute to the Institute's research on other issues.

The Analytical Chemistry Project develops new, sophisticated methods to measure organic and inorganic compounds in water, sediments and biota, while the Quality Assurance Project provides a national focus for quality control/quality assurance activities. The Ecotoxicology Project provides new biological assessment procedures for detecting the toxic and mutagenic effects of contaminants in lakes and rivers. A variety of statistical and process simulation models that permit reliable trend assessment, analysis and prediction of aquatic processes are being developed in the River Modelling Project and Hydraulics Project, and in several other studies. Expertise on the design, rationalization and interpretation of monitoring and surveillance programs is also developed.

Major new chemical methods were developed in 1987-88:

- A fully automated ion-chromatographic method for cadmium
- A comprehensive method for the determination of chlorophenols and chloranisoles in tissue
- The first quantitative use of supercritical fluid chromatography in a method for measuring non-ionic surfactants
- A radioimmunoassay technique for rapid pre-screening of samples for dioxins
- Improved methods for organochlorines and polychlorinated biphenols
- A laboratory fermentor technology for assessment of the biodegradation potential of contaminants such as alkyllead and chlorophenols.

The Goulden large-sample extractor, which permits field collection of concentrated extracts of water contaminants occurring at very low levels, was validated and accepted for use in the Canada-U.S. Niagara River Toxics Management Plan.

Interlaboratory quality assurance studies were completed for the Upper Great Lakes Connecting Channels Program, the Great Lakes Water Quality Surveillance Program, the Federal/Provincial Agreements Program, the Prairie Provinces Water Board, and the Long Range Transport of Airborne Pollutants Program. General data quality has been improved through these studies, and problems with data comparability and accuracy quickly identified for corrective action. National quality assurance studies on analysis of aldicarb and chlorophenols were also undertaken at the request of Conservation and Protection Service regional offices.

Ecotoxicological and biomonitoring research continued. Biomonitoring studies were conducted in the Yamaska River basin, Quebec, and elsewhere in Canada, on the use of benthic macroinvertebrate community structure, caged leeches, snapping turtles, freshwater mussels, and a variety of biochemical tests to monitor for food-chain effects of contaminants.

A modified oxygen-uptake toxicity assay for lake sediments was developed, as was a high-performance liquid chromatographic proce-

ture for the adenylate energy charge stress test in microorganisms.

Sampling of western Canadian lakes and rivers was completed as part of the assessment of the "battery of tests" approach to contaminant screening.

With the assistance of the International Development Research Centre, a combined coliphage/coliform procedure was evaluated as a simple, inexpensive approach to potable water evaluation in underdeveloped countries and rural areas without centralized water supplies.

A mathematical model was developed and validated to predict the impact of prolonged water level changes on the areal extent of shoreline marshes. The TOXFATE environmental contaminants model was also completed, validated with chlorobenzene and PCB data, and used to predict the fate of volatile halocarbons in Lake St. Clair and the major 1986 chemical spill into the River Rhine in Switzerland.

Existing models of the hydrodynamics and transport of fine sediment particles were critically evaluated in support of a major new research program on fine particle contaminant interactions. Improvements to wave forecasting and wave climate prediction models were also made. Comparisons of various steady-state and one-dimensional wave models with field measurements from Lake Ontario were completed. The WAVES (Water-Air Vertical Exchange Studies) field project, undertaken jointly with the Woods Hole Oceanographic Institute, was completed successfully in 1987-88. The unique and extensive database created will be used to improve predictive models for pollutant dispersal, wave formation, weather forecasting and climate change.

NATIONAL HYDROLOGY RESEARCH INSTITUTE

The role of the National Hydrology Research Institute (NHRI), located in Saskatoon, Saskatchewan, is to undertake research into aspects of the hydrologic cycle that enable better management and conservation of our water resources. The three phases of H₂O - vapour, liquid (water), and solid (snow and ice) - are addressed. Scientists carry out investigations

to understand the various physical processes at play and to determine the laws that govern them. This knowledge is then incorporated into models of various segments of the hydrologic environment. Thus, the consequences of changes in the system or cycle that might be induced, for example, by climate change, can be assessed. Furthermore, the impacts of human activities - changing agricultural practices, the introduction of toxics, the effects of industrialization and urbanization - can be monitored and measures developed for their mitigation.

Following a comprehensive review of research projects and priorities at NHRI and in the water research area, activities have been consolidated into three major programs covering climate change, man's impact on the environment, and the North. These have been identified as priority areas in Environment Canada. Within the broad categories, project areas have been identified and individual scientists are conducting studies related to them.

The National Hydrology Research Institute consists of three scientific divisions - the Surface Water, Ground Water and the Aquatic Environment divisions. The two support groups are the Staff Services and Research Support divisions. The Institute forms part of the National Hydrology Research Centre. The Centre also houses the Hydrometeorological Research Division and three Meteorological Inspectors from the Atmospheric Environment Service, as well as the Water Quality Branch Laboratory of the Western and Northern Region of Environment Canada.

Ground Water Research

By-products of industry and urbanization affect surface and ground water quality. NHRI scientists are studying the pathways of contaminants, their decay products and processes. For the sustained use of water resources, we must understand environmental relationships so that we can mitigate the effects of pollutants.

The systematic collection of ground water samples in the Turkey Lakes watershed continued until July 1987, at which time NHRI personnel in Sault Ste Marie relocated to Saskatoon.

Chemical concentrations in the ground water of the watershed are highly variable, with large spatial variations due to differences in permeabilities, mineralogy, stratigraphy, flow dynamics and biochemical processes. The ground water chemistry is controlled by carbonate-based weathering reactions, on which is superimposed the influence of the stratigraphic configuration of sediments in the various sub-basins. In general, ground water flow in the Turkey Lakes watershed is a two-layered system, reflecting the stratified till structure with much more rapid flow in the upper section which has fairly high permeabilities. Alkalinity is transferred to the surface by ground water flowing up from the lower and deeper system. The acid neutralization capacity of the shallow surficial tills appears to be limited by the carbonate weathering rate. If acid loadings remain the same, we can expect increasing acidity in the surface waters of the Turkey Lakes basin and similar watersheds in the Canadian Shield. Methods for the sampling and analysis of aluminum in ground water and the identification of its speciation have been developed and were tested in the Turkey Lakes watershed.

A model of the part of the hydrologic cycle directly affected by drainage improvements was constructed. It permits the simulation of specific drainage improvements and an assessment of the effect on discharge from a drained field. The model suggests that increased peak flows can be expected in the early stages, but improved soil drainage and aeration will subsequently cause peak flows to diminish. Ground water samples from Abbotsford and Osoyoos (B.C.), Taber (Alta.), and Outlook (Sask.) have been analyzed for pesticides, and some low levels have been detected. Scientists are investigating their inconsistent temporal and spatial occurrence. The Institute has created a large facility for indoor aquifer testing (FIAT) to study flow through porous media under controlled laboratory conditions at a scale large enough to minimize container effects. FIAT consists of a fibreglass tank with 11 access ports and a precipitation applicator and has the following features: dual water sampling filters, thermistors, pressure transducer pairs for adjusting the sampling rate, a drain system to adjust the water table, and a gutter to eliminate flow along the tank walls.

NHRI, in collaboration with the Canadian Parks Service, is assessing the long-term availability of surface and ground water to the ponds in the whooping crane nesting area of Wood Buffalo National Park, which is located between Lake Athabasca and Great Slave Lake.

Discussions continue with federal and provincial agencies over deep-well disposal. The Federal Panel on Energy, Research and Development (PERD) is supporting the validation of existing deep-well monitoring data and the evaluation of the Alberta Research Council's model to predict effects from active oil sands/heavy oil waste water injection wells.

Surface Water Research

The structure of the surface water research program reflects a need to understand processes in what may be quite different hydrological regimes - prairie, alpine and permafrost.

The Prairie Environment

The timing, availability and use of water in a prairie environment are extremely important. Land use practices alter rates of evaporation, transpiration, infiltration and runoff. Nutrients and toxic substances, designed to increase yields, may accumulate in the surface water. They degrade its quality and endanger aquatic life. NHRI scientists are examining current tilling and swathing practices and their impact. Tillage practices also affect snow retention, soil moisture, evaporation, and subsequent yields. It has been found that ploughing at a lower depth, or subsoiling, at a depth of 400-600 mm, 0.7-0.8 m apart, enhances the infiltration characteristics of frozen soil; yields increased 1098 kg/ha over those from undisturbed stubble.

In a cooperative project with Agriculture Canada and the Saskatchewan Research Council, it was found that 10.6% of the irrigation water is returned as drainage water. Most of the nutrient and herbicide loss occurred following the first irrigation. In total, 0.1% of the nitrogen, 0.22% of the phosphorus, 0.17% of the dicamba, 0.13% of the MCPA (4-[(4-chloro-o-tolyl) oxy] acetic acid), and 0.18% of the diclofop were lost to surface drainage. Herbicidal concentrations are well below the

acceptable LC₅₀ limits.

Evaporation and transpiration are important to the water balance of plants. NHRI is testing models to determine whether they reflect known physical processes and how they could be modified to provide better results. Researchers have found that the Complementary Relationship Areal Evapotranspiration (CRAE) model is extremely sensitive to dewpoint temperatures; for each degree change, evapotranspiration is affected by 10%. Lake, nutrient and sediment dynamics have been investigated in a variety of prairie lakes, including Southern Indian Lake and a chain of lakes in the Qu'Appelle Valley of Saskatchewan.

Drought is an ever present concern in the Prairies, particularly after a succession of dry years. Furthermore, the predicted CO₂ warming of the climate may increase drought frequency and intensity. Preliminary results of a study of drought show that the water storage mechanism is very important.

NHRI scientists are applying remote sensing techniques to studies of the prairie snow cover and are investigating the influence of snow structure on the absorption and reflection characteristics of electromagnetic signals. Researchers have modified a microwave model to simulate emission from up to three layers and from five different surfaces of land, water, ice and snow. It was found that both snow water equivalent and flooded area could be determined in the Red River basin from microwave observations. Other results, such as those found in alpine research, suggest that the complex impedance, which has been measured in cell volumes 10^5 mm^3 to 10^6 mm^3 at 10 kHz to 10 MHz, provides a possible index of snow microstructure.

The Alpine Regime

The alpine area is the site of an investigation into historical climate and the state of Canada's glacier resources. Hydrologic and climatic data records are extremely important. Trends, maxima and minima, must be established if we are to manage future water supply and use properly. NHRI scientists are in the forefront of developing palaeohydrologic and palaeoclimatic records.

An ice core obtained by NHRI from atop Mount Logan contains a record of temperature, precipitation, and the gases and aerosols in the atmosphere for about 300 years. Preliminary studies of the core show a good correlation with known precipitation data from Saskatchewan and from stations in the wooded steppe of the Soviet Union. The time scale has been confirmed from several secondary volcanic events whose signatures are chemically quite distinct. Two assumed climatic extremes occurred in 1705-1710 A.D. and between about 1850 and 1860. Paleoclimatic studies from northern Yukon indicate significant cooling at about these periods, suggesting that the ice core oxygen-isotope ratio perturbations are largely temperature-induced. Two of the three glaciers being studied in the Coast Mountains, near Vancouver, diminished in size during the past year. Helm Glacier has lost as much as one third of its surface area of 2.94 km² since 1977.

The North

In comparison with the prairie and alpine areas, the hydrologic cycle is quite different in the North. Snowmelt and runoff play a major role, but our ability to predict them is quite limited. NHRI scientists are studying the causes and effects of ice jams and the influence of changing water levels on parts of the northern ecosystem. Researchers continued field studies of breakup and ice jamming on the Liard and Mackenzie rivers, and investigated river waves that control the advance of breakup. Scientists conducted detailed energy balance experiments of the decaying ice sheet in conjunction with *in situ* measurements of ice strength. Results suggest that a borehole jack can be used to provide an index of ice strength during the decay period.

The location of frequent ice jams, their formation, composition, growth, backwater buildup and flow redistribution characteristics have all been documented.

In the Mackenzie Delta, NHRI scientists are investigating the timing, duration and frequency of flooding of the Delta lakes by the Mackenzie River and the magnitude of local snowmelt runoff. At the same time, they are assessing the potential environmental impact of

increased flow regulation of the Mackenzie River main stem.

Aquatic Ecology Research

Biological information is extremely important. Once we understand the impact of pollutants, such as toxics, pesticides, heavy metals and nutrients, on aquatic ecosystems, appropriate water quality criteria can be developed. Recent research at the NHRI Experimental Troughs Research Apparatus, near Chase, B.C., has shown that algal growth in rivers is a function of phosphorus concentrations, but only up to quite low levels of phosphorus enrichment. Above these levels there is no longer any appreciable effect. Such a finding has major implications for the establishment of water quality objectives for rivers in Canada and for the regulation of nutrient pollutants.

More emphasis is now being placed on realistic acute and chronic bioassay techniques to assess the effects of increasingly complex chemical burdens. The study of morphological deformities in midge larvae (Diptera: Chironomidae) is one of the biological techniques being developed by NHRI scientists as a means of assessing the long-term chronic effects of contaminants on such systems. Operational techniques for assessing deformities in *Chironomus* and *Procladius* larvae are currently well advanced, and as new field sites are analyzed, information on deformities in other genera is being collected:

- | | |
|------------------------------|-------------------------|
| • <i>Cryptochironomus</i> | • <i>Phaenopsectra</i> |
| • <i>Cryptotendipes</i> | • <i>Psectrocladius</i> |
| • <i>Dicrotendipes</i> | • <i>Coelotanytus</i> |
| • <i>Parachironomus</i> | • <i>Clinotanytus</i> |
| • <i>Paralauterborniella</i> | • Members of the |
| • <i>Polypedilum</i> | Tanytarsini |
| • <i>Paratendipes</i> | |

In the Flin Flon area of Manitoba, researchers have completed a study on the availability of toxic metals to fish and the relationship between metal speciation and bioavailability. As part of a study of pathways in Prairie and Shield lakes, work has been finished with respect to different geochemical processes and environmental factors influencing the methylation and demethylation of mercury by sedimentary microbes.

NHRI Research Expands

The National Hydrology Research Institute is still recruiting staff to replace those lost as a result of the relocation to Saskatoon. Strong links are being forged with universities and local federal and provincial agencies that promise to augment efforts to broaden the scale of research and to develop a comprehensive, multidisciplinary approach to major environmental problems in the water field.

WATER RESOURCES RESEARCH SUBVENTION PROGRAM

Following the cancellation of the Water Resources Research Subvention Program in November 1986, the Rawson Academy of Aquatic Science was awarded a contract in July 1987 to assess the value of the program during its existence from 1967 to 1987. A comprehensive report was completed and issued to 70 individuals and organizations. Comments were solicited and received from federal institutions and universities. Based on the report and comments, an Action Plan to restructure the Inland Waters Directorate (IWD) subventions program was developed and submitted to IWD Directors in February 1988. Development of a strategic response is in progress.

SOCIO-ECONOMIC STUDIES

The Federal Water Policy places a premium on socio-economic research, recognizing its importance to water resource policy, planning and management. In 1987-88, socio-economic activities burgeoned.

Water Use Studies

The fourth national survey (1986) of industrial water use has been completed, with all questionnaires returned, edited and entered into the database. A fifth national survey will be conducted in 1991 to match the five-year cycle of the Canada Census.

In 1986, the National Water Use Analysis Program (NWUAP) was incorporated as a basic component of the Inland Waters Directorate operations, with the Water Planning and Management Branch assigned the lead responsi-

bility. The core activities during 1987-88 coordinated under NWUAP include:

- Collection of water use data
- Integration of water use information with water quantity and quality data
- Modelling and analytical routines involving integrated water data
- Interpretation and dissemination of study results.

A National Water Use Data System (NAWUDAT) is considered a key component of the National Water Use Program. Progress in 1987-88 was made in the completion of a NAWUDAT proposal outlining a systems development concept and a five-year development schedule. As well, work commenced on preparation of available water use data for inclusion in NAWUDAT.

Work continued on the multi-phase study of Water Supply Constraints to Energy Development, which was initiated in 1981. The main product of the study has been the Water Use Analysis Model (WUAM). The model is being developed in a broader sense as an analytical tool for research planning and management of the interface between water availability and human use of the resource. In 1987-88, the Phase VI report was published, accompanied by a User's Manual for WUAM. Work commenced on further upgrading of WUAM under the Phase VII contract of the study.

Transferring WUAM capability to regional offices and, as appropriate, to the provinces is a major activity under the National Water Use Analysis Program. In 1987-88, a demonstration of WUAM using the South Saskatchewan River basin was conducted and a report written. Other regional applications of WUAM were begun for study areas in New Brunswick, Quebec and Ontario. The User's Manual is being updated to support the transfer of WUAM capability.

CCREM Study on Current Water Charging Practices

Significant involvement in the Canadian Council of Resource and Environment Ministers (CCREM) Municipal Water Infrastructure Financing Study began in 1987-88. Work focussed on Phase I, Current Water Charging Practices, and involved the compilation and tabulation of available

municipal water use and pricing data. The data were used as the basis for producing the first draft of the Phase I report, which is under review.

Regional Highlights

In 1987-88, socio-economic activities in the regions entailed:

- A regional application of WUAM in New Brunswick
- Preparation of a draft report on the application of WUAM to the Richelieu River basin in eastern Quebec
- Completion of a report on the socio-economic impacts of toxic substances in the Great Lakes basin
- An operational application of WUAM to the South Saskatchewan River basin
- A preplanning study recommending an environment-economy integration approach for the longer-term planning study of the Yellowknife River basin
- An application of the quadratic economic optimization model to the South Saskatchewan River basin.

International Involvement

Representatives from Canada attended meetings of the Economic Commission of Europe (ECE) Committee on Water Problems and the Organization for Economic Cooperation and Development Natural Resources Management Group. The Canadian contribution to a joint proposal, with Norway, for a study on the Ecosystems Approach to Water Management was completed for submission to the ECE Committee on Water Problems.

Chairmanship and general support were provided to the Organization Committee for the International Water Resources Association's Sixth World Congress on Water Resources to be held in Ottawa, May 29 to June 3, 1988.

Assistance was provided in completing a report on Inland Waters Directorate involvement in international activities.

Public Awareness of Water Issues

In 1987-88, work accelerated toward enhancing public awareness of water issues. An inventory

of Environment Canada water communication activities was completed, and its evaluation was begun as part of the development of a national water awareness and education strategy. Other activities contributing to public awareness are:

- Revision of the Water Fact Sheet series
- Promotion of public awareness and education efforts in the regions
- Development and circulation of program display units
- Numerous public presentations and special publications.

SERF/WUAM Models

In 1987-88, contract work commenced on producing an Environment-Economy Linkages Model with a water focus. The primary goal of the study is to establish linkages between the Socio-Economic Resource Framework (SERF) Model, produced by Statistics Canada and operated by the University of Waterloo, and WUAM. Preliminary design options for interfacing SERF and WUAM were developed as the basis for further detailed study.

Greenhouse Effect

Activities related to long-term climate change, or the "greenhouse effect," accelerated in 1987-88. Participation on the Socio-Economic Impacts Committee (SEIC) of the Canada Climate Program (CCP) continued. The SEIC is a specialized advisory committee responsible for scientific coordination and review with regard to the Canadian Climate Impacts Program, one of four program areas of the CCP.

A project designed to examine the impact of climate change on water use and management, with WUAM as the main analytical tool, was initiated.

At the regional scale, awareness and assessment of climate change and potential socio-economic impacts are being actively encouraged and supported.

Acid Rain

Involvement continued in 1987-88 with respect to the long range transport of airborne pollutants (LRTAP), or acid rain. Most

activities were associated with participation on the Conservation and Protection Service LRTAP Socio-Economic Steering Committee (SESC). The Committee is responsible for the coordination and review of the socio-economic component of the Conservation and Protection LRTAP program. Work focussed on establishing a multi-year action plan and formulating specific study proposals for the next fiscal year.

Additional Activities

Other wide-ranging activities in the socio-economic field involve:

- Monitoring progress of the socio-economic component of the Canadian Nuclear Fueled Waste Disposal Program
- Supporting socio-economic aspects of involvement in the federal-provincial water management programs for the Mackenzie and South Saskatchewan River basins
- Publishing documents on diverse subjects, e.g., agricultural water pricing, water charges to power companies, water demand management
- Advising on socio-economic policy with respect to a number of water-related issues.

WATER DATA

Programs for the systematic collection and compilation of data on streamflow, water levels, sediment transport, ground water, water quality, and related information on glaciers, snow and ice predated the Canada Water Act but have continued to operate in support of water management basin studies and implementation programs. A newer innovation is the collection of background data on water use by municipal and industrial users in Canada.

At the National Water Research Institute, water data activities in support of water data collection include programs of quality assurance and analytical methods adaptation for the water quality program and current meter calibration for the water quantity program.

At the National Hydrology Research Institute, data collection activities support specific research programs relating to surface and ground water, and to aquatic ecology. Up-to-date information on glaciers and snow and ice continues to be maintained.

Water-Related Data Systems

Data System	Data Provided
WATDOC	Inventory of water- and environment-related articles and reports
NAQUADAT	Water quality data, including chemical, physical, bacteriological, biological, hydrometric data, collected for the national water quality monitoring program
STAR	Limnological data on the Great Lakes
WATENIS	National inventory of industrial and municipal water pollution sources including data on physical, chemical and toxicological characteristics of effluents, and information on water effluent regulations and guidelines
MUNDAT	Information about municipal waterworks and wastewater systems in Canada, compiled in cooperation with provincial governments and the Federation of Associations on the Canadian Environment
HYDAT	Data on streamflow, water levels, and sediment transport collected through federal-provincial water quantity agreements; it also includes water quantity data contributed by other organizations that meet national standards in data collection procedures and accuracy
CHOMS	Inventory and summary description of selected operational techniques and procedures used to collect, process and manipulate hydrological data in water resources studies. (The CHOMS database was developed as the Canadian contribution to the HOMS project of the World Meteorological Organization (WMO) for the organized transfer of hydrological technology operationally used in water resources investigations by member countries of WMO.)
Glacier Data and Information System	Compilation of physical dimensions of Canadian glaciers and a bibliography of Canadian glacier documents

DATA MANAGEMENT SYSTEMS

Data and information reference systems are essential to water resource planning and management. Federal and provincial governments, universities and the private sector depend on this information. The data systems in operation during 1987-88 are listed in the table on page 33. One of these systems is a database producer of the Inland Waters Directorate, WATDOC.

WATDOC

Through the AQUAREF database, WATDOC provides the scientific and technical community, as well as the general public, with French and English bibliographic references to water- and environment-related documents. For easy access, the citations are also listed in a specialized bibliography on hydrology. This

316-page book was produced by WATDOC in 1987 for the Associate Committee on Hydrology of the National Research Council.

During 1987-88, WATDOC was highly visible to the public. WATDOC personnel participated in conferences across Canada. They gave demonstrations on the content of AQUAREF and on techniques for searching the file. And to provide more comprehensive marketing of the Inland Waters Directorate databases, WATDOC teamed up with the Water Resources Branch and the Water Quality Branch, thus including demonstrations of the NAQUADAT and HYDAT databases.

The interest generated concerning WATDOC is reflected in the large number of information requests received each year. As well as answering specific requests, WATDOC produces a newsletter highlighting recent developments and sample searches.

Part II: Water Quality Management

No water quality management areas, as defined under Part II of the Canada Water Act, have been set up. However, there are a number of federal-provincial implementation agreements under which water quality management programs have been or are being implemented. These include programs in the Great Lakes basin and in the Okanagan and Qu'Appelle basins. While these agreements do not provide for the establishment of water quality management agencies under Part II of the Act, they nevertheless have the same objectives of maintaining and improving water quality and are managed by joint federal-provincial boards.

The federal government, in concert with provincial governments, has completed the development of water quality management strategies for the St. Lawrence River (Quebec), the Souris River (Manitoba-Saskatchewan), and the Shubenacadie-Stewiacke rivers (Nova Scotia). Also, a Canada-Ontario-Quebec Coordinating Committee is working to establish a water quality monitoring plan for the Ottawa River; a Canada-British Columbia Committee is overseeing the implementation of a management program in the Fraser River Estuary; and a Canada-Manitoba Team has completed a mercury study in the Churchill River diversion.

New Canadian Water Quality Guidelines

In 1987, the Canadian Council of Resource and Environment Ministers (CCREM) published the first edition of the *Canadian Water Quality Guidelines*. The Guidelines, prepared by the CCREM Task Force on Water Quality Guidelines, are a compilation of information on specific water quality parameters that indicate whether water is suitable for the following major uses:

- Raw water for drinking water supply
- Recreational water quality and aesthetics
- Freshwater aquatic life
- Agricultural uses
- Industrial water supplies.

The Guidelines address more than 50 specific substances of concern, including many toxic substances, and are designed to harmonize water quality efforts throughout the country. Associated environmental information for some 120 water quality parameters is also provided. The intent of the *Canadian Water Quality Guidelines* is to describe the effects of water quality parameters on water uses and to assist in the preparation of site-specific water quality objectives, which take local environmental and socio-economic conditions into consideration.

Since publication in May 1987, over 3000 copies of the *Canadian Water Quality Guidelines* have been distributed to federal and provincial agencies, national and international organizations, as well as to domestic and foreign associations and agencies, consultant groups, libraries, and the research community.

In 1987, the CCREM Task Force on Water Quality Guidelines also produced a report on research needs identified during the preparation of the *Canadian Water Quality Guidelines*. The Task Force is currently developing a priority list of research needs from this report. This activity will help orient future research so that it will be useful in the preparation of new and revised guidelines for water quality in Canada.

Future Guidelines

The CCREM Task Force on Water Quality Guidelines is continuing in its role of recommending water quality guidelines and is currently developing guidelines for nutrients in flowing waters and guidelines for several pesticides in current use. As well, the CCREM Task Force is considering the feasibility of developing sediment quality guidelines to complement their work on the water quality guidelines.

Part III: Regulating Nutrient Inputs

The federal government launched its phosphorus concentration control program in the late 1960s. Regulations limiting the maximum phosphorus content of laundry detergents to 8.7% elemental phosphorus (P) by weight, or 20% phosphorus pentoxide (P_2O_5), were established in 1970. At that time, an inspection program was introduced under which product samples were collected from manufacturers and importers for government analysis. It is estimated that these initial regulations resulted in a 22% reduction in the amount of phosphate discharged from all detergent sources (from 26 000 000 kilograms to 20 000 000 kilograms per annum).

On January 1, 1973, the maximum permissible phosphorus content for laundry detergents was reduced to a maximum of 2.2% elemental phosphorus by weight (or 5% P_2O_5). In 1973, a national network of regionally based inspectors was formed. Since then, samples of laundry detergents and other products have been

collected and analyzed annually. In 1987-88, 200 random samples of commercially available laundry detergents were analyzed for phosphorus content. Of these, 12 were found to contain phosphorus in excess of the regulated limit. All violations are being examined to determine what further action is required.

The initial concern about phosphorus in laundry detergents centred on the identification, in the Great Lakes, of eutrophication (accelerated aquatic plant growth due to an overabundance of nutrients such as phosphorus). However, the detergent regulations under the Canada Water Act are not only meant to apply to phosphorus control in the Great Lakes. They have been designed to protect the myriad of small Canadian lakes suffering from eutrophication that have not, and likely will not, be serviced by centralized facilities that could be upgraded to tertiary treatment for the removal of phosphorus. The Phosphorus Concentration Control Regulations are still necessary to protect small lakes throughout Canada.

Status:

The Canada-Quebec Agreement was signed on December 10, 1983. The regulation dam was operational by December 1985 and completed in 1986.

The ministers agreed in August 1985 to reallocate funds already in the agreement in order to increase funding for studies from \$30 000 to \$230 000; these studies are directed toward improving the regulation efficiency of the control structure. By March 31, 1988, total expenditures were expected to amount to \$8.9 million, of which the federal share would be \$4 million. In September 1987, federal authority was obtained for an extension of the agreement to March 31, 1989. As of March 31, 1988, the Quebec Government had not obtained its authority for the amendment. This extension would permit the completion of studies and the implementation of works downstream from the Grand Moulin Dam, to raise certain streets in the city of Laval.

FLOOD DAMAGE REDUCTION PROGRAM

1. CANADA-MANITOBA FLOOD PROTECTION PROJECTS

Objective: To increase the level of protection afforded by ring dykes in the Red River Valley communities of Rosenort, Morris, St. Adolphe, Dominion City, Emerson, St. Jean Baptiste, Letellier and Brunkild, and to provide protection to the community of Ste. Rose du Lac and the water treatment facility at Souris.

Duration: March 10, 1983 to March 31, 1989.

Participants and Funding:

CANADA.....	\$2 745 000
MANITOBA.....	\$3 355 000

Prior Action: Between 1967 and 1971 Canada and Manitoba cooperated in the construction of dykes around seven Red River basin towns that had suffered damages during the 1950 flood and again in 1966. Subsequent experience demonstrated, most recently in 1979, that the dykes constructed under the 1967 Agreement did not provide a sufficient margin of safety nor did they meet the standards of the Canada-Manitoba Flood Damage Reduction Agreement signed in 1976. Thus, a new agreement was signed to upgrade the seven ring dykes that had been jointly built earlier, as well as an eighth dyke, around Brunkild, which had been built and fully paid for by Manitoba.

Status: The agreement was signed on March 10, 1983, and a committee was formed to administer it. The agreement was amended in May 1985 to include the construction of a dyke at Ste. Rose du Lac and the upgrading of the dyke at the water treatment plant at Souris with additional funding of \$1 600 000. The earthwork and permanent pumping facilities have been completed at Brunkild, Rosenort, Letellier, St. Jean Baptiste and Morris. Some upgrading has been completed at Emerson and St. Adolphe. The communication/storage facility in Morris is complete and the emergency pumps for the communities have been purchased. The communication towers for all communities have been constructed.

Construction on the Ste. Rose du Lac project was delayed by landowners whose land would be expropriated for the project. A public inquiry in September 1987 concluded that the project should proceed as designed and the project has been rescheduled for 1988-89. With the delays in the Ste. Rose du Lac project and the international section of dyke at Emerson, an extension may be required to complete the projects.

2. MILLE ILES FLOOD CONTROL STRUCTURE

Objective: To reduce the level of flood damage along the Rivière des Mille Iles in the Montreal Region.

Duration: December 1983 to March 1987.

Participants and Funding:

CANADA.....	\$5.9 000 000
QUEBEC.....	\$7.2 000 000

Prior Action: Studies to determine the feasibility of a flood control structure on the Rivière des Mille Iles were conducted under the Agreement respecting dykes and flow regulation works - Montreal Region.

- (2) A water use model, based on the Inland Waters Directorate, Headquarters, Water Use Analysis Model;
- (3) A hydroelectric power simulation model developed by the Saskatchewan Power Corporation;
- (4) A water quality (nutrients) model.

A series of public consultation meetings were held, and a Delphi study involving public and private sector groups and individuals with an interest in water management in the basin was initiated to develop water management objectives to be used during the evaluation phase of the study.

7. CANADA-PRINCE EDWARD ISLAND ARRANGEMENT RESPECTING WATER MANAGEMENT FOR ECONOMIC DEVELOPMENT

Objective: To evaluate existing water use demands and constraints; to demonstrate means of increasing water's sustainable contribution to economic development in Prince Edward Island; and to identify future development potential in the province's water resources bases, i.e., ground water, surface water, and estuaries.

Duration: April 1, 1987 to March 31, 1990.

Participants and Funding:

CANADA.....	\$500 000
PRINCE EDWARD ISLAND....	\$500 000

Status: The arrangement was signed by the Minister of Environment Canada and the Minister of the Prince Edward Island Department of Community and Cultural Affairs on October 26, 1987. The same date a Memorandum of Understanding on Conservation and Development between several key federal and provincial government agencies was signed.

The work-shared arrangement, scaled down from an initial \$2.5 million proposal, deals with key water issues on the Island concerning ground water, surface water, and estuaries. In 1987-88, the following projects were planned and initiated.

The ground water program addresses several problems and includes a study of areas where ground water availability is limiting economic growth, an assessment of pesticides in ground water, and the demonstration of techniques to prevent contamination of individual wells. The surface water program will assess the impacts of various land use patterns on water quality and on fish habitat. Pilot projects will be implemented to demonstrate techniques to improve water courses for fish habitat. The estuary program addresses several problems that affect the health of the Island estuaries vital to finfish and shellfish production. They range from obstructions such as causeways to poor water quality in particular bacterial contamination.

The arrangement also deals with the problems and economics of water and wastewater systems, especially the design and operation of on-site sewage disposal.

Ten percent of the budget has been designated for environmental education. Plans are being designed to reach a wide audience with information on water resources and environmental management.

ratify the loading targets and reach agreement on Canadian and U.S. programs to meet these targets were partially completed in 1983. The Protocol signed in 1987 consists of new provisions that strengthen the two governments' attack on toxic substances with new requirements to address contaminated sediments, ground water, airborne toxic substances, and non-point sources.

Arrangement:

The International Joint Commission was given primary responsibility for overseeing implementation of this international water quality agreement. The Commission has established a number of boards and committees to carry out the various provisions of the agreement. Activities are carried out under four programs: Objectives Development, Controls, Assessment, and Special Projects (including toxics, eutrophication, health hazards, etc.). The 1987 Protocol commits the two governments to coordinate implementation and evaluate progress under the agreement through semi-annual meetings.

Status:

In 1986, Canada and Ontario agreed on the implementation of a Phosphorus Control Supplement as recommended under Annex III of the 1978 Agreement. The Control Supplement agreed to on October 16, 1983, includes measures to both protect the upper Great Lakes and further reduce phosphorus discharges to the lower Great Lakes. The agreement ratifies the phosphorus loading targets and allocates the residual load reductions to Lake Erie between the United States and Canada.

The 1978 Agreement was reviewed following receipt and examination of the IJC's third biennial report. This report was presented to the governments of Canada and the U.S. in the spring of 1987. The review of the agreement by the two federal governments was undertaken, as in the past, in full consultation with the provinces of Ontario and Quebec and the eight Great Lakes states. During the latter part of 1985, the Royal Society of Canada and the U.S. National Academy of Science jointly reviewed the progress by the jurisdictions in implementing the 1978 Agreement. This joint report was helpful in the review by the governments.

The 1978 Canada-U.S. Great Lakes Water Quality Agreement was amended with the signing of the Protocol in November 1987. The Protocol reaffirms the commitment to the cleanup of the Great Lakes and outlines expanded responsibilities for the parties.

6. SOUTH SASKATCHEWAN RIVER BASIN STUDY

Objective:

To develop a framework plan to guide long-term water resources development in the South Saskatchewan River basin.

Duration of Agreement:

May 1986 to December 31, 1989.

Participants and Funding:

CANADA.....\$800 000
SASKATCHEWAN.....\$800 000

Status:

Water quality, supply and use data, and water development proposals have been catalogued, and the development of analytical tools for the evaluation phase of the study (1988 and 1989) is under way. Four models were being developed during 1987-88:

- (1) A water quantity simulation model, based on Alberta Environment's Water Resources Management Model;

The renewed agreement provides \$82.1 million for surveillance, upgraded sewage treatment, and phosphorous control programs. Each of the governments will contribute \$9.6 million for surveillance to determine concentrations of pollutants in the Great Lakes. In addition, each will give \$1.4 million to a new program to control phosphorus. Special funding in the amount of \$65 million was made available to Ontario for the period 1982-1985 to assist in the completion of municipal sewage facilities construction to meet the requirements of the Canada-U.S. Agreement. This extra funding was formalized under the 1982 Canada-Ontario Agreement. Some \$9.7 million of the original funds were not expended, and this amount has been committed over the next two years. Ontario and area municipalities will contribute an additional \$50.4 million to upgrade present sewage treatment facilities or build new ones.

Status:

In February 1981, a joint Canada-U.S. team of scientists began a comprehensive investigation of toxic substances in the Niagara River. The final report on this investigation, released in November 1984, contained 24 recommendations pertaining to point source and non-point source control, further investigations and monitoring. A detailed long-term water quality monitoring program was included. On October 30, 1986, the Niagara River Toxics Management Plan was announced and formalized by the signing of a "Declaration of Intent" in February 1987. In 1987-88, the plan was implemented. A four-party status report on activities was released in July 1987, and a four-party data analysis report, in January 1988.

Because, as already noted, the Canada-Ontario Agreement is being undertaken to provide a basis for implementing the Canada-U.S. Agreement on Great Lakes Water Quality, a brief outline of activities under the latter agreement is also provided.

CANADA-U.S. AGREEMENT ON GREAT LAKES WATER QUALITY

Objectives:

To improve the quality of the water in the areas of the Great Lakes now suffering from pollution; to ensure that Great Lakes water quality will be protected in the future; and to restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes basin ecosystem.

Duration of Agreement:

Continuous since April 1972; revised agreement signed November 22, 1978; amended 1983; 1987 Protocol signed November 1987.

Participants:

CANADA
UNITED STATES

Commitment:

The concept of the Great Lakes basin and its human resources as an ecosystem is explicitly recognized in the new agreement. Numerical water quality objectives for some 40 compounds have been specified. Approximately 99 percent of the sewered population on the Canadian side of the basin is now served by adequate municipal wastewater treatment facilities. Programs to control and prevent pollution from industrial sources entering the Great Lakes System have been designed and are being implemented. A commitment has been made to eliminate the discharge of toxic substances into the Great Lakes. New interim phosphorus loading targets, defined for each lake, are designed to achieve desirable levels of water quality. Binational negotiations to

Status:

All of the possible 14 projects were completed. A four-person Steering Committee and an eight-person Technical Advisory Committee were appointed with an equal number of federal and provincial members. A Study Coordinator provided the necessary management support, coordinated the projects and information, and developed the public awareness component of the agreement. Annual reports for fiscal years 1983-84 and 1984-85 were prepared and distributed widely to government and public agencies. In 1987, a Summary Report and Technical Appendices (four volumes) were approved by the ministers of Environment for Canada and Manitoba and distributed.

5. CANADA-ONTARIO AGREEMENT ON GREAT LAKES WATER QUALITY

Objectives:

To renew and strengthen cooperation between Canada and Ontario in meeting the obligations under the revised 1978 Canada-U.S. Agreement and to provide for cost-sharing of specific programs that the province will undertake with the federal government in meeting these obligations.

Duration of Agreement:

April 1971 to March 31, 1990; agreement renewed in 1976, 1982 and 1986.

An initial agreement from August 1971 to December 31, 1975, authorized \$3 million for feasibility studies and joint sewage treatment technology and urban drainage research. Loans totalling \$250 million for sewage treatment facilities from the Canada Mortgage and Housing Corporation (CMHC) and the Ontario Government were also called for in the initial agreement. (Funding for municipal sewage treatment between 1976 and the signing of the new agreement in 1982 was the subject of a separate agreement with CMHC under the National Housing Act.)

The agreement was renewed in March 1976, retroactive to January 1, 1976, as a basis for establishing joint water quality objectives, and to serve to coordinate and implement federal and provincial input to Canadian responsibilities under the international agreement, and to conduct research. This agreement expired on March 31, 1980, but because a revised agreement was then under negotiation, the 1976 Agreement was extended to March 31, 1982, through exchanges of letters between ministers. The agreement was renewed in July 1982 and again on March 6, 1986.

Participants and Funding:

CANADA
ONTARIO

The participants each pay half the cost associated with the research and surveillance programs. For each fiscal year, the total amount payable by Canada shall not exceed an amount to be agreed upon between Canada and Ontario, taking into account:

- (a) The recommendations made by the International Joint Commission relevant to the Great Lakes International Surveillance Plan as developed under the revised Canada-U.S. Agreement;
- (b) The decisions made, as a result of such recommendations, by the parties to the Canada-U.S. Agreement with respect to such surveillance;
- (c) The recommendations of the Board of Review.

In 1974, the federal government increased its contribution to the Flood Control Program and Storage Studies from \$18 000 000 to \$30 500 000, and British Columbia agreed to increase its share by the same amount. In fiscal year 1976-77, both parties agreed to increase the funding to \$60 000 000 for each party, and to extend the agreement to March 31, 1984. In fiscal year 1983-84, the agreement was extended to December 31, 1986, with no increase in funds. In fiscal year 1985-86, the agreement was extended to March 1995 and funding was increased by \$41 million. Total funding committed to the program by both governments increased to \$161 million.

Status:

Construction has been completed at Kent, Matsqui, Surrey (Serpentine-Nicomex Dams), New Westminster, Coquitlam, Abbotsford, Kamloops (Oak Hills), Surrey-South Westminster, Richmond, Pitt Meadows, Delta, and at the Vedder River is nearly complete. Construction was well advanced for the South Dewdney, Pitt Meadows #2. Final design is well under way for Glen Valley and has been initiated for the Coquitlam River Project. Estimated expenditures under the program to March 31, 1988, are \$129 000 000. The current annual funding rate is \$2 500 000 from each government.

4. CHURCHILL RIVER DIVERSION SYSTEM - MERCURY STUDY

Objectives:

To determine the degree to which mercury is present in the Churchill River Diversion system and to identify sources; to study pathways and mechanisms by which mercury moves from water to fish and wildlife through the food chain; to monitor the concentration of mercury in aquatic plants and fish and compare it with available data on the presence of mercury in people living in this area; and, where possible, to suggest remedies to local mercury problems and means of predicting future occurrences of mercury contamination.

Duration of Agreement:

March 1983 to September 1986.

Participants and Funding:

CANADA.....\$380 000
MANITOBA.....\$380 000

Background:

This study arose from concern over increased levels of mercury in fish along the diversion route. Area soils and mineral deposits contain background levels of inorganic mercury which may have been released when the area was flooded. This problem was first addressed under the Northern Flood Agreement that the Department of Indian and Northern Affairs negotiated on behalf of Canada in 1977-78 between Canada, the province, Manitoba Hydro, and the Northern Flood Committee (a collectivity of various Indian Bands). An arbitrator, appointed in March 1980 under the terms of the Northern Flood Agreement, to arbitrate claims from any of the four parties concerned, identified the mercury agreement as a priority federal-provincial responsibility.

The Canada-Manitoba Agreement on the Study and Monitoring of Mercury in the Churchill River Diversion was signed on March 10, 1983. The agreement allowed for cost-sharing of expenditures made by Canada and Manitoba retroactive to April 1, 1982. The four-year agreement was scientific in nature and had five broad objectives aimed at improving the knowledge and the ability to respond to mercury problems in northern Manitoba.

Prior Action: The Fraser River Estuary Management Program is based on a study conducted between 1977 to 1982. The Fraser River Estuary Study examined means to accommodate population and growth while protecting valuable environmental assets of the estuary.

Status: The agreement provides for the implementation of several program activities: the coordinated Project Review Process, Activity Programs, a Water Quality Plan, Area Designation, and Public Consultation.

The Standing Committee on the Fraser River Estuary Water Quality Plan has addressed coordination of water quality work in the estuary. It has prepared a Status Report and is developing a Water Quality Plan. Key components of the plan will be water quality monitoring and the establishment of water quality objectives.

A coordinated interagency referral process is now in formal operation and so is an Environmental Review Committee. Coordination of project review is supported by a computerized central project registry.

Six Activity Programs have developed Terms of Reference and are under way. The programs involve log management, waste management, emergency management, habitat management, recreation management, and navigation and dredging.

2. QU'APPELLE CONVEYANCE AGREEMENT

Objective: To complete the conveyance works begun under the Qu'Appelle Implementation Agreement (1974-1984).

Duration of Agreement: April 1, 1984 to March 31, 1989.

Participants and Funding:

CANADA.....	\$2 375 000
SASKATCHEWAN.....	\$2 375 000

Status: During the fourth year of the agreement, 1987-88, Canada spent \$518 000. The 1987-88 work was predominantly concerned with leveling the spoil piles adjacent to the channel improvement work of 1986-87. Channel improvement work was carried out immediately downstream from Highway #6, which completes the channel improvement work in the reach between Highway #6 and Pasqua Lake.

3. FRASER RIVER FLOOD CONTROL PROGRAM

Objectives: To provide protection from flooding of land in the lower reaches of the Fraser River Valley and other areas upstream by rehabilitating existing dykes, constructing new dykes, increasing river bank protection, and improving internal drainage facilities.

Duration of Agreement: 1968 to March 31, 1995 (extended).

Participants and Funding:

CANADA.....	50%
BRITISH COLUMBIA.....	50%

(Local authorities are responsible for providing construction and access right-of-way.)

To assist it in making its decisions, the Board has traditionally maintained a full-time engineering support group in Ottawa within the Inland Waters Directorate of Environment Canada. This group was formally established as the Board's Secretariat with the signing of a Memorandum of Understanding in 1981.

To ensure two-way communications with interests within the basin, the Board has recognized a number of specific interest groups, each of which has appointed a representative to the Board. Groups represented include hydropower utilities, pulp and paper industries, native people, cottage owners, and tourist outfitters.

The Board holds public meetings each year to provide detailed information to the public and to obtain feedback on the effects of levels and flows. A phone-in information service is maintained to ensure that the public has ready access to information on current conditions in the basin. Also available are a brochure on water regulation in the basin and fact sheets on water levels for anyone planning to build a dock.

Since the Lake of the Woods is an international boundary water, the federal member of the Board serves as Member for Canada on the International Control Boards for Rainy Lake and Lake of the Woods, to ensure coordination with the United States.

Status:

The Board continued to manage the outflows from Lake of the Woods and Lac Seul and kept the public advised of conditions. Apart from direct regulation activities, the Board is continuing to improve its data collection and analysis procedures and has plans to introduce mathematical modelling to assist it in its deliberations.

WATER MANAGEMENT PROGRAMS

1. FRASER RIVER ESTUARY MANAGEMENT PROGRAM

Objective: To guide economic development while protecting the environment of the Fraser River Estuary.

Duration of Agreement: October 1985 to December 31, 1990.

Participants and Funding: A Management Committee Executive has been established representing:
ENVIRONMENT CANADA
FISHERIES AND OCEANS CANADA
MINISTRY OF ENVIRONMENT AND PARKS (B.C.)
THE FRASER RIVER HARBOUR COMMISSION
THE NORTH FRASER HARBOUR COMMISSION

The agreed total cost is \$1 250 000; annual costs to be shared equally by the five parties are not to exceed \$250 000.

The agreement also established a management committee with representation from the federal and provincial governments, municipalities, regional districts, port authorities, and Indian bands located around the estuary to oversee the implementation of the management program.

Prior Action: The Mackenzie Basin Intergovernmental Liaison Committee was established in 1973 and reconstituted as the Mackenzie River Basin Committee in a Memorandum of Understanding between the participating governments in May 1977. In May 1978, a \$1 600 000 program to study the water and related resources of the basin was endorsed.

The study has been completed and the final report was released by the ministers on February 26, 1982. The main recommendations call for early negotiations toward a transboundary water management agreement, an expanded network of water data stations, followup field studies on ice breakup, and a major study of the Mackenzie Delta.

Status: The Mackenzie River Basin Committee continued to meet during 1987-88 to fulfill its liaison and information exchange responsibilities. A general agreement that would grant member status to the governments of the Northwest Territories and Yukon has been developed. Implementation of Recommendation 1, an agreement through which transboundary water management issues can be addressed, is being pursued outside of the Mackenzie River Basin Committee. Seven bilateral sub-agreements between the various jurisdictions will precede the development of a master agreement under the Canada Water Act. Bilateral discussions between Alberta/ Northwest Territories, Alberta/ British Columbia, Alberta/ Saskatchewan, and Saskatchewan/ Northwest Territories have been initiated. Discussions between B.C./ Yukon and B.C./ Northwest Territories are expected to commence shortly.

7. LAKE OF THE WOODS CONTROL BOARD

Objective: To control and regulate certain major waterways in the Winnipeg River drainage basin to achieve water flow and level conditions that are reasonably acceptable to the various interests.

Duration of Agreement: Continuous. The Board was established in 1919 under a Dominion Order-in-Council, and was confirmed by federal legislation in 1921 and by Ontario legislation in 1922. At that time, jurisdiction of the natural resources of the four western provinces was vested in Canada, and therefore the member for Canada acted on behalf of Manitoba. Manitoba gained active membership in 1958.

The Board was established under the Lake of the Woods Control Board Act and is reported upon here only because of its association with other water management programs.

Participants and Funding:

CANADA	- one member
ONTARIO	- two members
MANITOBA	- one member

Canada pays one third of the Board's annual operating costs in the interest of navigation. The remaining two thirds is paid by Manitoba and Ontario in the proportion of developed hydropower head in the basin in each province.

Arrangements: The Board fulfills its responsibilities by directing what the outflows from Lake of the Woods and Lac Seul (and at times the flows diverted from Lake St. Joseph) should be.

The mathematical regulation model is operated on a real-time basis during the spring flood period to serve as a guide to reservoir operations. In 1986, flood reserves were implemented in three reservoirs, on a trial basis to facilitate the operation of the Mille Iles dam.

Subcommittees have been established to study the impact of using flood reserves in some reservoirs, to develop risk management methodology for the Ottawa River basin, and to develop bylaws and procedures for the Board.

5. OTTAWA RIVER WATER QUALITY COORDINATING COMMITTEE

Objective: To review monitoring data and other information on water quality of the river; to undertake or recommend special studies as needed; to recommend water quality objectives for the river; to recommend and evaluate pollution control activities.

Duration of Agreement: Continuous from 1983.

Participants: CANADA
QUEBEC
ONTARIO

Prior Action: A Technical Work Group on Water Quality in the Ottawa River was formed in 1980 to study problems related to bacteria and toxic substances in the Ottawa River basin; to identify quantities and sources of nutrients; and to evaluate the importance of agricultural and other diffuse sources of phosphorus. It was hindered from carrying out its mandate by gaps in the data available and, in its report of October 1981, recommended the establishment of a committee to coordinate monitoring, and proposed a monitoring plan to obtain the data needed.

Status: The first annual report of the Coordinating Committee noted some improvement in water quality in the river, particularly in bacterial quality, and recommended adoption of water quality objectives and emphasis on control of nutrients, bacteria, dissolved oxygen, and PCBs. The Committee is currently preparing a second report which deals specifically with pulp mill and municipal effluent.

6. MACKENZIE RIVER BASIN COMMITTEE

Objective: To exchange information on potential water-related developments in the basin and to recommend to the ministers studies which would gather data on the basin's water and related resources.

Duration of Agreement: Continuous since 1973.

Participants: CANADA.....Department of the Environment,
Ministry of Transport, Department of Indian
and Northern Affairs, Yukon Territory, and
Northwest Territories.
ALBERTA
BRITISH COLUMBIA
SASKATCHEWAN

annually and both the study results and the updated information are being stored in a computerized format for retrieval by interested agencies and individuals.

The Board's Committee on Groundwater has prepared reports showing cross sections, or profiles, of ground water conditions along the Alberta-Saskatchewan boundary and the Saskatchewan-Manitoba boundary. The Committee is also coordinating the tabulation of a bibliography of ground water reports and data related to interprovincial ground water evaluations.

The Board also examines the quantity and quality effects that proposed projects might have on streams at interprovincial boundaries. The results of each evaluation are reported to the Member Agencies.

4. OTTAWA RIVER REGULATION PLANNING BOARD

Objective: To plan and recommend criteria for regulating the Ottawa River, taking into account hydropower production, flood protection, navigation, low water problems, water quality needs, and recreation.

Duration of Agreement: Continuous since March 1983.

Participants:
CANADA (3 members)
ONTARIO (2 members)
QUEBEC (2 members)

Canada assumes initial responsibility for financing the cost of the agreement, with Ontario and Quebec each contributing 25%.

Prior Action: As a result of recommendations made following a study of flooding in the Montreal region in 1976, a Canada-Ontario-Quebec Ottawa River Regulation Planning Committee was established in 1977 by an exchange of letters between the federal Minister of the Environment, the Quebec Minister of the Environment, and the Ontario Minister of Natural Resources. The final report of the Planning Committee was submitted in December 1980 recommending that a tripartite regulation agreement be negotiated. Negotiations then followed, culminating in the signing on March 2, 1983, of a Canada-Ontario-Quebec Agreement respecting Ottawa River Basin Regulation.

Arrangement: The Ottawa River Regulation Planning Board administers the agreement. It also formulates and reviews regulation policies and criteria concerning integrated management of the principal reservoirs in the basin.

A regulating committee, composed of operators of the principal reservoirs, is responsible for ongoing operation of the reservoirs, within the guidelines established by the Board.

Status: A secretariat has been established within Environment Canada to act as the executive arm of the Board.

During the spring flood period (March 1 - May 30), forecasts on a real-time basis are provided daily for the principal reservoirs in the Ottawa River basin and at selected points where flooding takes place.

Participants and Funding:

CANADA
ALBERTA
MANITOBA
SASKATCHEWAN

(Funding to be borne one half by Canada and one sixth by each of the provinces.)

Arrangement:

Schedule C of the Master Agreement on Apportionment provides for the reconstitution of the Prairie Provinces Water Board whose responsibility is to oversee and report on apportionment of waters flowing from one province into another province; to take under consideration comprehensive planning, water quality management and other management problems referred to it by the entities concerned; to recommend appropriate action to investigate such matters; and to submit recommendations for resolution of the problems.

Status:

The agreement is administered through the Prairie Provinces Water Board, its Committees, and its Secretariat.

The Board, through its Committee on Hydrology, has established procedures for the determination of natural flow for eight interprovincial streams: South Saskatchewan River, North Saskatchewan River, Saskatchewan River, Qu'Appelle River, Churchill River, Battle Creek, Lodge Creek and Middle Creek. Natural flows are calculated on an annual basis for the streams. Procedures for computing natural flow for 17 other small interprovincial streams have been prepared and documented. The procedures will be used when monitoring of apportionment is required for these small interprovincial streams.

With respect to interprovincial drainage problems in the Langenburg-Russell area between Saskatchewan and Manitoba, the Board has accepted the report entitled "Interprovincial Drainage Affecting the Rural Municipalities of Churchbridge and Langenburg in Saskatchewan and Shellmouth and Russell in Manitoba," and agreed that it would be used as a basis for resolving future interprovincial drainage problems.

At the request of the Board, the Water Quality Branch of Environment Canada reports monthly on water quality at 11 monitoring sites. These stations are part of the Board's long-term network to monitor water quality in the prairie provinces. The Board's Committee on Water Quality (COWQ) has prepared Proposed Water Quality Indicators for each of these 11 stations. The Proposed Indicators were presented to the Board in the fall of 1986, and are now being reviewed by the Board's agencies prior to any further action being taken. COWQ has prepared detailed supporting documents for the first six PPWB monitoring sites to assist the agencies in their review. This Committee, under the direction of the Board, also has established a Task Force on Analytical Methodology to provide a means of quality assurance and coordinating water quality laboratory results for the prairie provinces. The Task Force has prepared a draft report for COWQ to present to the Board in the fall of 1988. The report is entitled, "Initial Report on Assessing the Comparability of Water Quality Data Generated by the Federal (ECS) and Provincial Laboratories on the Prairies."

The report entitled "Water Demand Study - Historical and Current Water Uses in the Saskatchewan-Nelson Basin" was released to the public on February 10, 1983. The water use information in that report is updated

Water quantity surveys now include technologically advanced techniques such as satellite communication telemetry systems and a nationally distributed electronic data processing system. A national meeting of all agreement coordinators was convened in October 1987 to discuss long-term technology plans.

2. WATER QUALITY MONITORING AGREEMENTS

Objective: To establish a nationwide water quality monitoring network that will make it possible to assess water quality on a national basis and at the same time meet the needs of the provinces.

Duration of Agreement:

To March 31, 1988, agreements have been signed with Quebec, British Columbia and Newfoundland. The agreements contain no termination date, but there is provision for termination by either party within a specified period of time after written notice. Agreements with other provinces will contain similar provisions.

Participants:

CANADA....Department of the Environment
ALL PROVINCES

Arrangements:

In designing the agreements to meet the needs of both the federal and provincial governments, the party(s) who will conduct the work are identified, and the costs of the program are shared in accordance with the value of the information to each party.

Funding:

Costs are determined according to the schedules appended to each agreement. Federal stations will be funded 100% by Canada; provincial stations will be funded 100% by the province; federal-provincial stations will be funded equally by each party. In 1985-86, Treasury Board authorized the Department to spend up to \$2 139 000 annually to fund agreements.

Status:

The agreements with Quebec, British Columbia and Newfoundland became effective in 1983, 1985 and 1986, respectively. Negotiations for agreements with Manitoba, Saskatchewan and New Brunswick are nearing completion. Negotiations with Prince Edward Island and Ontario are progressing well. At the administrative level, negotiations with Yukon and the Northwest Territories are continuing. However, major questions concerning funding have yet to be addressed. In 1988-89, negotiations are scheduled to commence with Nova Scotia.

3. PRAIRIE PROVINCES WATER BOARD

Objective:

The equitable apportionment of interprovincial prairie waters flowing eastward. The agreement ensures that one-half the natural eastward flow of waters arising in or flowing through Alberta is reserved for Saskatchewan, and that one-half the eastward flow arising in or flowing through Saskatchewan is reserved for Manitoba.

Duration of Agreement:

Continuous since October 30, 1969.

REGULATION, APPORTIONMENT, MONITORING AND SURVEY PROGRAMS

1. WATER QUANTITY SURVEY AGREEMENTS

Objective: To maintain a viable and efficient national water quantity survey network and to give recognition to joint federal and provincial responsibilities in this activity.

Duration of Agreements:

Agreements between Canada and each province were signed in 1975 and letters were exchanged between the Department of Environment (DOE) and the Department of Indian and Northern Affairs (DINA) agreeing to joint survey operations in the provinces and territories. The programs are continuous, but there is a provision in each agreement for termination on 18 months' written notice.

Participants: CANADA....Department of the Environment, and
the Department of Indian and Northern Affairs
representing the Yukon and Northwest Territories.
ALL PROVINCES

Arrangements: Data are gathered, analyzed and interpreted to meet client's needs in the hydrologic community. This is a shared-cost program, with the federal government carrying out field and office procedures and invoicing the provinces quarterly. An exception is Quebec, which operates the program in that province and invoices the federal government quarterly except for international and navigable waters, and waters crossing federal land in Quebec, which are surveyed by the federal government. DINA transfers funds annually to DOE for the territories' share of costs.

Funding: 1987-88 (provisional costs)

Total Program Costs	\$23 500 000
Total Recovered from Provinces	5 800 000
Total Paid to Quebec by Canada	714 604

Total Program Costs are the expenditures required to conduct the National Water Management Data Program.

The Total Recovered from Provinces is the amount reimbursed by the provinces, except Quebec, to Canada. The Total Paid to Quebec by Canada is the amount paid by Canada to the province of Quebec for operating stations of federal interest in that province.

Status: Coordinating Committees, established for each province, convene at least annually but normally more frequently to review the water quantity survey networks and to determine annual cost sharing. National meetings of all Coordinating Committees are convened periodically to ensure common practices are followed in administering the agreements.

A second national meeting of administrators was held in April 1987, at which a major topic was the cost recovery of employee benefits. The cost-share agreement was endorsed by all of the administrators as an example of a highly effective federal-provincial cooperative effort.

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**Principal Federal-Provincial Cooperative
Arrangements under the
Canada Water Act**

The new agreement is the first of its kind in Canada. The quality and quantity of P.E.I.'s water resources are critical to agriculture, fisheries and tourism sectors and, therefore, to future job opportunities in the province. The purpose of this three-year agreement is to maximize the contribution water resources can make to the economic development of P.E.I.

in ways that will be environmentally sound in the long term. All of the component projects of the new agreement will fall under the Canada Water Act, and federal contributions will be funded from that source. Special public information and education programs will also be developed as part of the agreement.

Part IV: Public Information Program

A well-informed public and clearly defined channels for public participation provide the best assurance that water management decisions will take into account the full spectrum of public values.

- Federal Water Policy

The federal government is committed to keeping Canadians informed about the state for their water resource. The public information program enables the public to achieve a perspective on water-related problems, both regional and national, and thus decide how to contribute to their solution.

In 1987-88, some major federal water management activities were announced.

NEW FEDERAL WATER POLICY

Large-scale water export is just one of the 25 specific issues addressed by the Federal Water Policy. Released in November 1987, the policy deals with many Canadian concerns, ranging from water quality to water shortages.

The policy encourages a preventive rather than reactive approach to water-related problems. It affirms that the actions of individuals as well as organizations can be effective in the conservation of our water resources.

A description of the Federal Water Policy may be found on page 3 of this report.

GREAT LAKES PROTOCOL SIGNED

On November 18, 1987, the Canadian Minister of the Environment and the Administrator of the U.S. Environmental Protection Agency signed the 1987 Protocol to the 1978 Canada-U.S. Great Lakes Water Quality Agreement. Through their signatures, the governments of Canada and the United States reaffirmed their commitment to clean up and restore the Great Lakes.

FEDERAL GOVERNMENT TAKES ACTION TO REDUCE GREAT LAKES WATER LEVELS

A progress report outlining eight federal actions to combat the problem of high water levels on the Great Lakes has been released. Environment Canada is sponsoring a coordinated communications program to provide the public with comprehensive information on the water levels issues.

The program entails extensive financial support for the Water Level Communications Centre in Burlington (described on page 5) and the Weather Forecast Centre in Toronto. During periods of flood-risk, both centres operate 24 hours, seven days a week, to provide readily understandable weather data to residents living on or near the Great Lakes.

CLEANUP OF WINDERMERE BASIN IN HAMILTON HARBOUR

In a recent public survey, seven in ten Canadians said that they were "very concerned" about toxic chemicals in the environment.

On April 13, 1987, the ministers of Fitness and Amateur Sport and of the Environment announced that in recognition of environmental considerations and civic concerns, the federal government has agreed to provide \$1.25 million toward the cleanup of the Windermere Basin in Hamilton Harbour, Ontario.

\$1-MILLION CANADA/P.E.I. WATER RESOURCES WORK-SHARING ARRANGEMENT SIGNED

In Charlottetown, on October 26, 1987, a unique \$1-million three-year Canada/Prince Edward Island Work-Sharing Arrangement on Water Resource Management for Economic Development was signed by the federal Environment Minister and the P.E.I. Minister responsible for the environment.